POPULAR SCIENCE

DECEMBER · 35c *Monthly*

Why We Smoke So Much PAGE 86

New U.S. Small Car PAGE 65

50 Pages on Tools

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Buying tips
How to use

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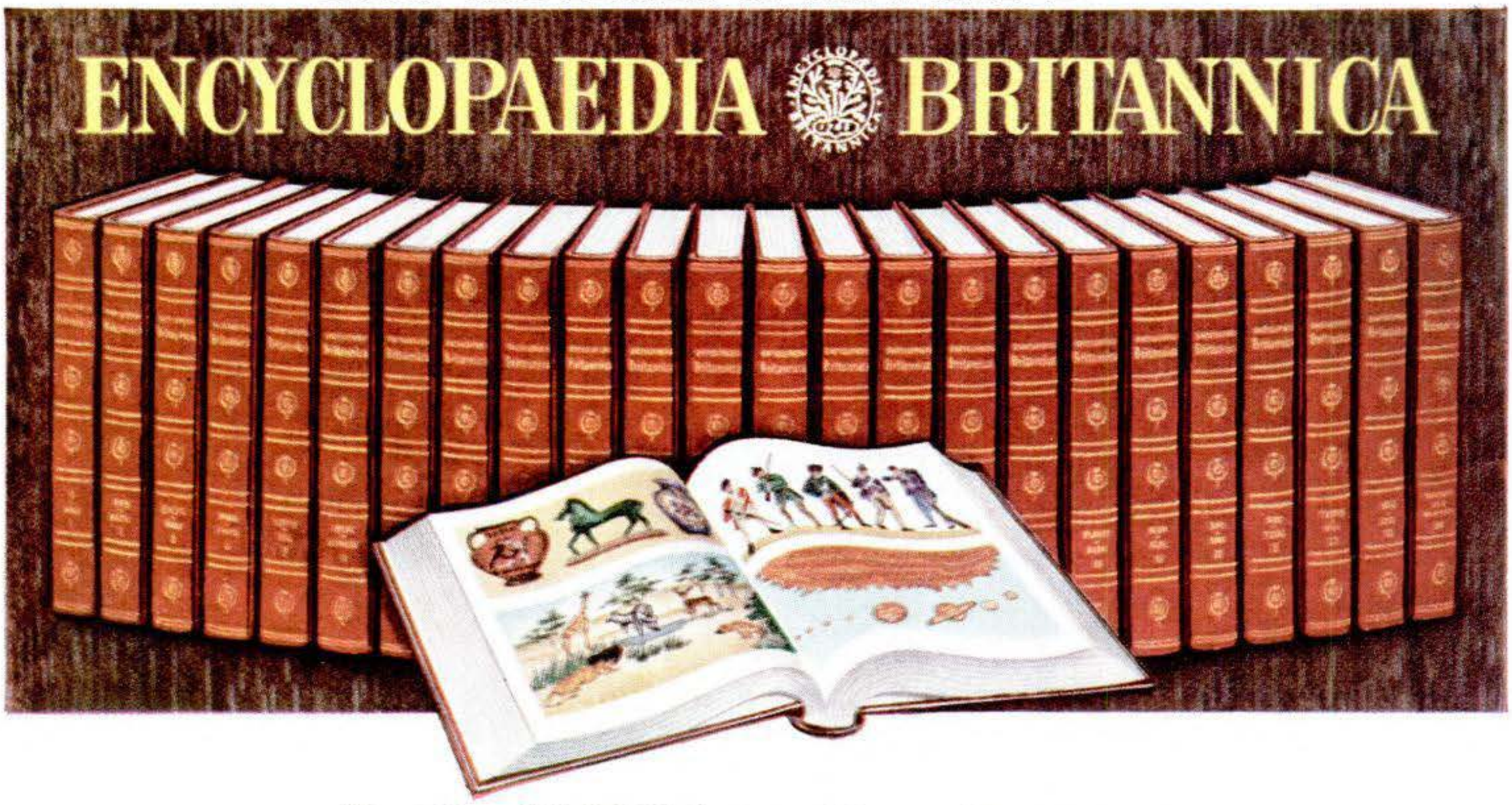

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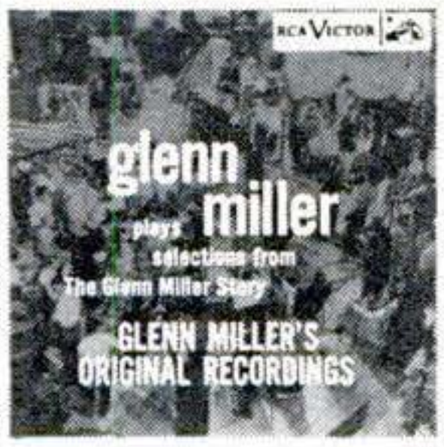
The great Dorsey group of the late 30's and early 40's. Featuring Sinatra, Berigan, Stafford, Pied Pipers. 12 selections, including *Marie, Star Dust, I'll Never Smile Again, Song of India.*

★★★★★★★★★★★★★★★★

GLENN MILLER



Miller's best, including *Moonlight Serenade, In the Mood, Tuxedo Junction, String of Pearls, Little Brown Jug, St. Louis Blues, Pennsylvania 6-5000, Farewell Blues, Kalamazoo.*

★★★★★★★★★★★★★★★★

BENNY GOODMAN

The King, his band and Quartet, at their swinging best; with Krupa, Hampton, etc. *Sing Sing Sing, One o'Clock Jump, And the Angels Sing, Stompin' at the Savoy, Bugle Call Rag,* etc.

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Duke's all-time best band, 1940-42, with Hodges, Webster, Blanton, Stewart, Williams, Carney. *"A" Train, I Got It Bad, Perdido, Cotton Tail, Main Stem, Blue Serge, Flaming Sword.*

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ARTIE SHAW

Shaw's two most successful big bands in 12 hits recorded in 1938-43. *Begin the Beguine, Nightmare, Frenesi, Star Dust, Dancing in the Dark, Temptation, All the Things You Are,* etc.

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Exciting offer to new members of

THE RCA VICTOR POPULAR ALBUM CLUB

A 5-ALBUM SET OF SWING CLASSICS

for only $3.98

RETAIL VALUE AS HIGH AS $19.90

...if you agree to buy five albums from the Club during the next twelve months from at least 100 to be made available

THIS exciting new plan, under the direction of the Book-of-the-Month Club, enables you to have on tap a variety of popular music . . . and, once and for all, takes bewilderment out of building such a well-balanced collection. **You pay far less for albums this way** than if you buy them haphazardly. For example, the extraordinary introductory offer described above can represent an approximate 33⅓% saving in your first year of membership. **Thereafter you can continue to save up to 33⅓ %.** After buying the five albums called for in this offer, you will receive a **free** 12-inch 33⅓ R.P.M. album, with a nationally advertised price of at least $3.98, for every two albums purchased from the Club. **A wide choice of RCA VICTOR albums will be described each month.** One will be singled out as the album-of-the-month. If you want it, you do nothing; it will come to you automatically. If you prefer an alternate—or nothing at all—you can make your wishes known on a simple form always provided. You pay the nationally advertised price—usually $3.98, at times $4.98 (plus a small charge for postage and handling).

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Please register me as a member of The RCA VICTOR Popular Album Club and send me the five-album set of Swing Classics, for which I will pay $3.98, plus a small charge for postage and handling. I agree to buy five other albums offered by the Club within the next twelve months, for each of which I will be billed at the nationally advertised price: usually $3.98, at times $4.98 (plus a small postage and handling charge). Thereafter, I need buy only four such albums in any twelve-month period to maintain membership. I may cancel my membership any time after buying five albums from the Club (in addition to those included in this introductory offer). After my fifth purchase, if I continue, for every two albums I buy I may choose a third album free.

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*Address*_____

PLEASE NOTE: Send no money. A bill will be sent. Albums can be shipped only to residents of the U. S., its territories and Canada. Albums for Canadian members are made in Canada and shipped duty free from Ontario.

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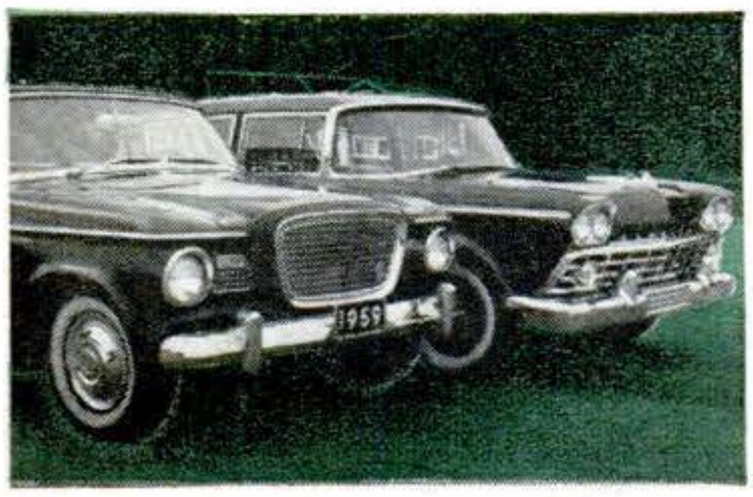
Popular Science Monthly

December, 1958

Cover photograph by W. W. Morris and Robert D. Borst



Here's catnip for the man who really meant it when he asked Detroit for a small car: Studebaker's Lark, jaunty as a Tyrolean hat, only 175 inches separating its license plates.

What happens when you take that deep drag? And why do you do it, anyway? Here's the inside report.

WORLD OF SCIENCE

Man's First Leap Toward Free Flight · 70
Infrared: New Uses for Invisible Light · 92
Battle of the Missile Fuels · 107

CARS AND DRIVING

Studebaker's New Lark vs. Rambler · 65
The New Edsel, Mercury and Lincoln · 74
Driving with an Automatic Choke · 119

AUTO UPKEEP

Hints from the Model Garage · 123
Gus Clears the Way for Christmas · 126

SPECIAL FEATURES

Why We Smoke So Much · 86
6 Ways to Sharpen Your Memory · 112
Hi-Fi Buyer's Guide to FM Tuners · 132

PICTURE NEWS

New Section—Planes, Rockets, Missiles:
Copter Shoots Up at 60 M.P.H. · 80
Inflating a Satellite · 82
Reactor Drives Jet Engine · 85
Boat Runs on Car Power · 98
Hot Chemicals Produce Electricity · 103
Solar Furnace Heat-Tests Materials · 104
Science Probes Monkey Mother Love · 106

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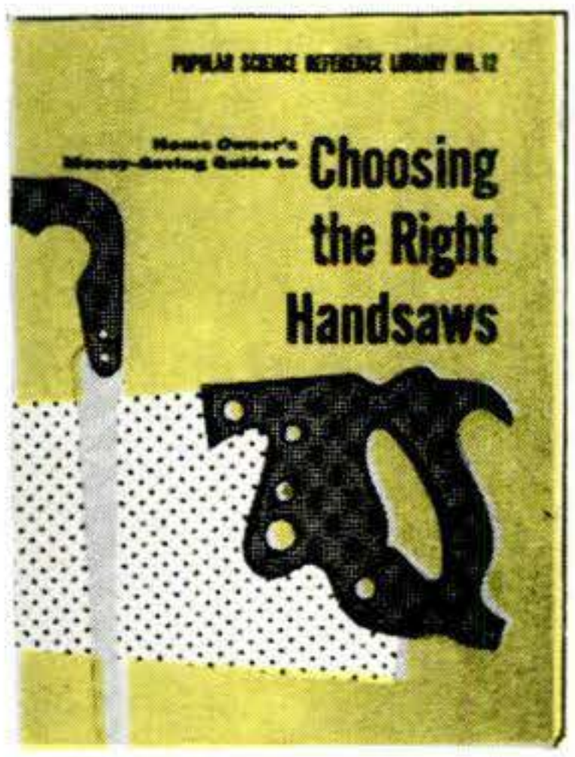
SPECIAL TOOL SECTION

A Word to Wise Wives · 137
Which Tool Should You Buy First? · 138
All About Buying Electric Drills · 142
A Saw Blade That Cuts Plywood Smoothly · 148
What's New in Power Tools · 151
What's New in Carbide Abrasives · 158
What's New in Hand Tools · 160
What's New in Shop Accessories · 166
A Shop Built for the Radial Saw · 170
A Saw Table with Folding Wings · 171
Complete Tear-Out Booklet:
Choosing the Right Handsaws · 177
Soldering Guns Do Extra Jobs · 190

Now . . . the facts about drills. Here's what to look for, plus specs to help you find it.

HOME AND SHOP

Home Owner's Repair Section:
Know-How File: Using a Nail Hammer · 196
Materials File: Wood-Screw Chart · 197
Fix-It File: Stairways · 199
Short Cuts and Tips · 204



For your reference shelf: PS presents a complete 12-page guide to handsaws.

EVERY MONTH . . .

PS Readers Talk Back · 4
The Month in Science · 15
You Ought to Know · 18
I'd Like to See Them Make · 91
Budget Savers · 111
New Ideas from the Inventors · 116
Wordless Workshop · 202

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EDITORIAL OFFICES:
353 Fourth Ave., New York 10, N.Y.

ADVERTISING OFFICES:
NEW YORK—353 Fourth Ave.
CHICAGO—360 North Michigan Ave.
DETROIT—820 Book Bldg.
SAN FRANCISCO—114 Sansome St.
CLEVELAND—636 B. F. Keith Bldg.
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PORTLAND, ORE.—520 S.W. Sixth Ave.

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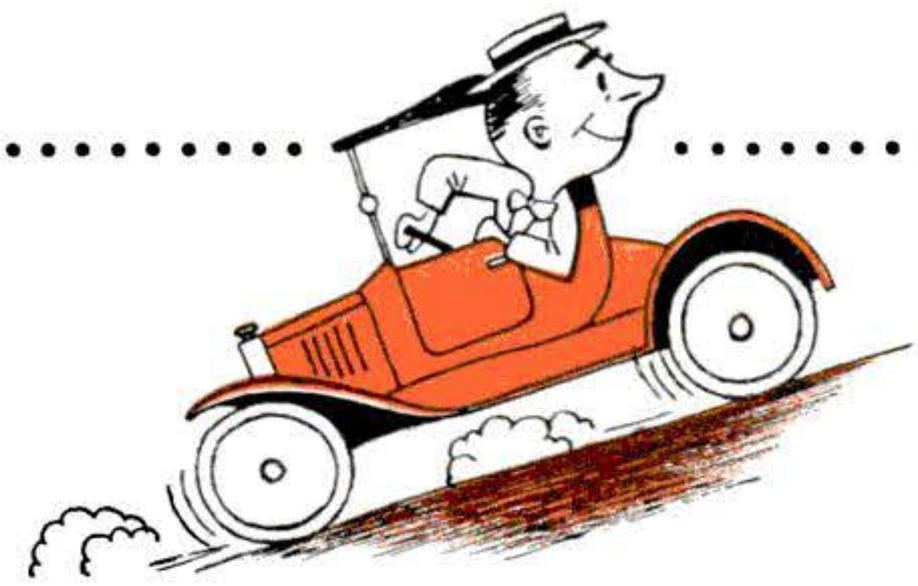
PS Readers

TALK BACK



Paging Gus Wilson

How about getting Gus to sound off in a cracker-barrel discussion going on around here:

1) An old-timer claims that his Model T Ford could go up a steeper grade in reverse than in forward gear. Why?

2) A school-bus driver says he shifts to neutral and coasts to a stop to let off passengers. If a student decides not to get off after he has shifted, he maintains he can't shift back into gear until the bus comes to a full stop. How come?

3) A young hot-rodder argues that a new car broken in slowly, then driven slowly for some time, will always be a slow car. True or false?

W. J. KIMMEL, Brookville, Ohio.

1) On a steep hill, the carburetor might well be higher than the under-seat gas tank. Result, in a gravity-feed system: no gas. Solution: reverse the car.

2) A little know-how is needed here. Revving the engine and double-clutching would synchronize box and road speed, and permit an easy shift from neutral.

3) You shouldn't break in a car slowly —consistently. Drive moderately for a while, then gun the engine a bit to load it, and vary road speeds when cruising.

Defensive Driving Is Cheered

I'VE recommended to the AAA that they reprint your article "How to Defend Yourself on the Highway" [Sept.] in their publication. As a contribution to public welfare, it seems too important to restrict by copyright.

I have been driving since the Cadillac came out with four cylinders, each with a separate copper water jacket. But I always gain from the advice of men who make a living by driving. We can all learn a lot about safe and skillful driving from race drivers, truckers and highway patrols. Now how about an article on the less obvious "Indian signs" that signify accident-prone situations? One I'm suspicious of: a cluster of cars on the turnpike.

HENRY STEVENS, Washington, D.C.

. . .Your article on defensive driving should be reprinted as a driver's manual for distribution by every state motor-vehicle department in the Union.

You mention the California Highway Patrol's safety record of .19 accidents per 100,000 miles—a phenomenal feat considering the work they are engaged in. But you might also like to know that our drivers have established a fleet record of .18 accidents per 100,000 miles—the new National Safety Council record.

We have several drivers who have covered over a million miles without an accident. These are the boys who haul those diesel monsters with 30-40,000-pound loads in one of the most highly congested areas of the country.

VICTOR D. OLUP,
R-C Motor Lines, Newark.

PS Subscription Pays Off

CHEERS for your Home Owner's Repair Section. The information is always valu-

able and that article on the maintenance and repair of automatic washers [Aug.] was worth a whole year's subscription.

CALVIN JONES, Spokane.

Car Dealers Applaud New Law

ARTICLES that tend to discredit *all* automobile dealers ["What the New Car Price Law Means to You," Sept.] are very unfortunate. They only prejudice

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How we retired in 15 years with $300 a month

We're having a wonderful time, Betty and I. We're doing all the things we've always dreamed of doing. We enjoy our home. Summers, we pack the car and take trips. And it's all thanks to a check for $300 that comes by mail, as regular as clockwork, every month!

Luckily for me, I was only forty when Betty began to worry about our future. "You're going to want to slow up in a few years," she'd say. And I'd laugh. Because I felt fine. "But you won't always want to work," she'd say. "Well, I still have fifteen good earning years ahead of me," I'd answer.

But one day she stopped me. She asked me how much I'd earn in the next fifteen years —not counting raises. I did some quick arithmetic, multiplying my salary by fifteen. It ran up into *six figures!* I grinned.

Betty wasn't impressed. "How much of that do you think we'll save?" she asked. I had to be honest. We were always paying off on a new car or a radio, or going places. "A thousand or two," I admitted.

"That's just our trouble," she said. "We can't seem to save. You ought to take out one of those retirement income plans right now."

So I looked into the subject and discovered the Phoenix Mutual Retirement Income Plan. It was a way I could make part of my salary *now* buy me a retirement income *later*. All I needed was to start in time. With a Phoenix Mutual Plan, I could get a check for $300 a month for life, starting in fifteen years, when I reached fifty-five. I applied immediately and qualified.

The big day came fifteen years later, when our first Phoenix Mutual monthly check for $300 arrived in the mail. *I retired.* Now Betty and I are having the time of our lives—with no money worries.

Send for Free Booklet

This story is typical. Assuming you qualify at a young enough age, you can plan to have an income of $100 to $300 a month or more—starting at age 55, 60, 65 or older. Send the coupon and receive, by mail and without charge, a booklet which tells about Phoenix Mutual Plans. Similar plans are available for women. Don't delay. Send for your copy now.

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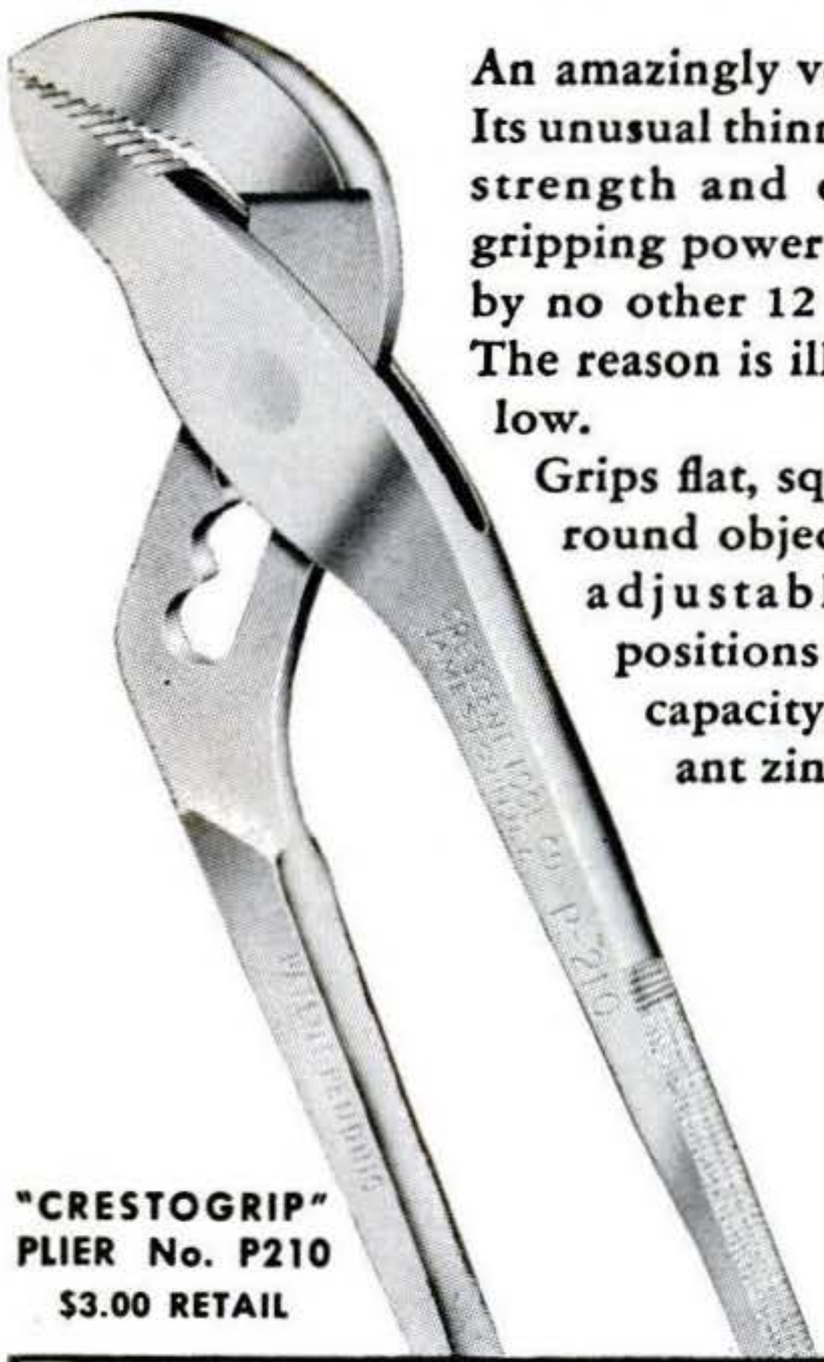

An amazingly versatile tool. Its unusual thinness, extreme strength and exceptional gripping power are equalled by no other 12 ounce tool. The reason is illustrated below.

Grips flat, square, hex or round objects. Jaws are adjustable to four positions up to 1½" capacity. Rust resistant zinc plating.

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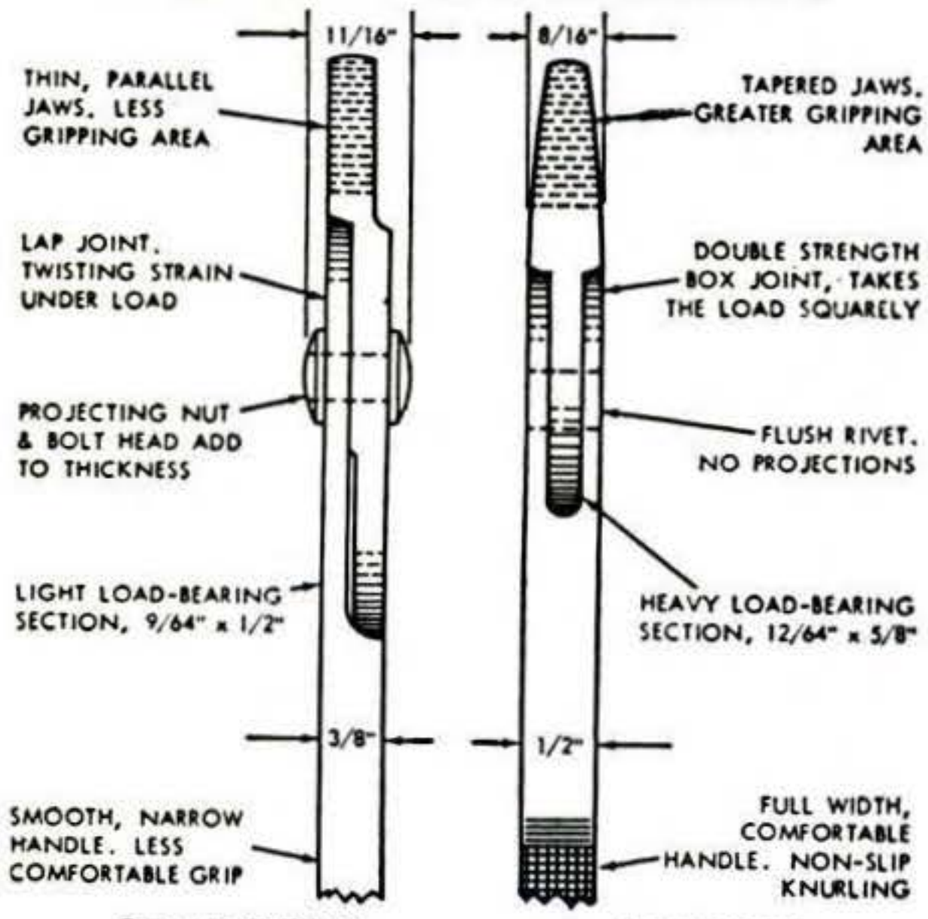

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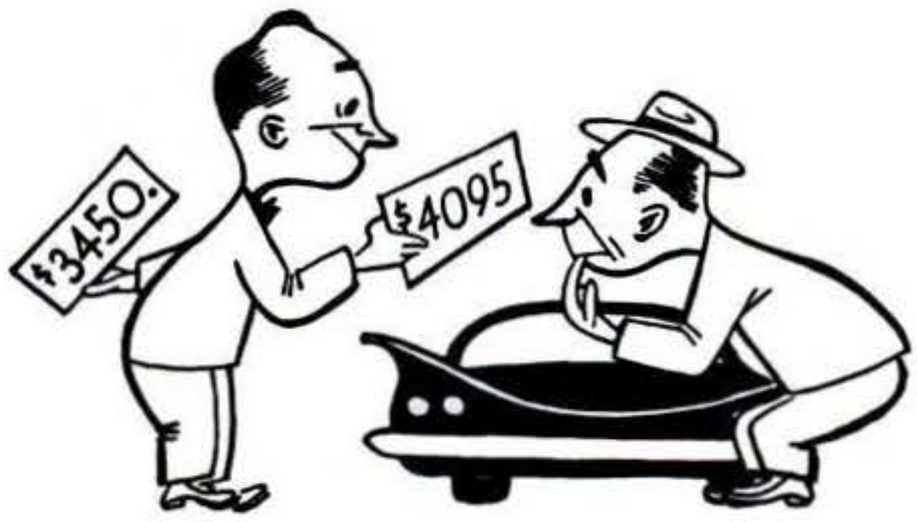
the buying public. I think you'll agree that the great majority of dealers are sound, ethical businessmen who are not attempting to deceive or cheat the public. As in any industry, there is a small minority who do attempt all the tricks in



the book but—again as in any industry—they eventually go out of business.

The new labeling law had the unanimous and enthusiastic support of the National Automobile Dealers Association when it was introduced in Congress. Indeed, the president and many outstanding members testified in behalf of the bill. They are delighted that it is now law and welcome it because it will help the ethical dealers and will deter the unethical ones.

BOYCE TOPE, Exec. V.P.,
Detroit Auto. Dealers Assn., Detroit.

Caught with Our Paints Down

YOUR report on aluminum roof paints [Aug.] interested me so much that I went right out to buy some of this roofing in a can. But when I tried to find the New York manufacturer you mention, I couldn't locate him. What gives?

MEL JOHNSON, Brooklyn, N.Y.

Sorry, this maker moved and we didn't get the word prior to press time. At the moment, the nearest manufacturer to the N.Y. area is the North Jersey Paint Co., Wallington, N.J. For a complete list of makers, write the Aluminum Co. of America, Pittsburgh, Pa.

Tip for 1960-Car Designers

Boy, what a drooly flock of new gadgets on the '59 cars! The rear-view mirror that flips when it's stabbed by an overtaking headlight beam [Oct.] is the most.

If Detroit runs out of ideas for clever doodads like this, I have one to suggest. Mine isn't nearly as glamorous, and it's stolen from ancient steamship practice.

Aboard ship each running light has two filaments—if one burns out you switch to

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WHAT HAPPENS WHEN A MAN DECIDES TO DO SOMETHING ABOUT HIS FUTURE!

The proven rule of "learn more to earn more" took M.E.F. (name on request) from a position of truck driver to that of an accounting executive in sixteen months. Listen to what M.E.F. says:

"I was driving a truck—working long hours and not making much money. I had a burning desire to better myself in life, and decided to enroll with LaSalle. I went along driving my truck days and studying nights and got my first break after completing 35 assignments. I took a cost accounting position. Within one month after starting full-time, I received my first raise, thereafter followed more. One of the greatest thrills of my life came just nineteen months after I started with LaSalle. When our firm opened up a branch office, I was assigned to take charge of the Accounting Department and my salary has doubled."

M.E.F. took a proved road to success—and his letter is typical of the thousands we have in our files from men and women in all walks of life.

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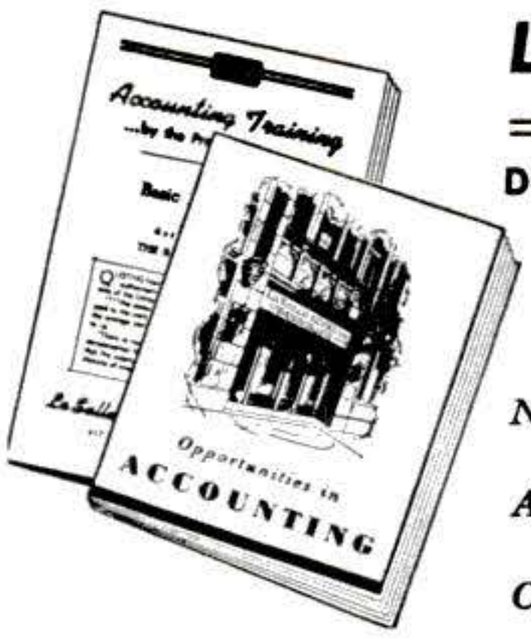

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the other. You hear a buzzer when a filament burns out and opens the circuit.

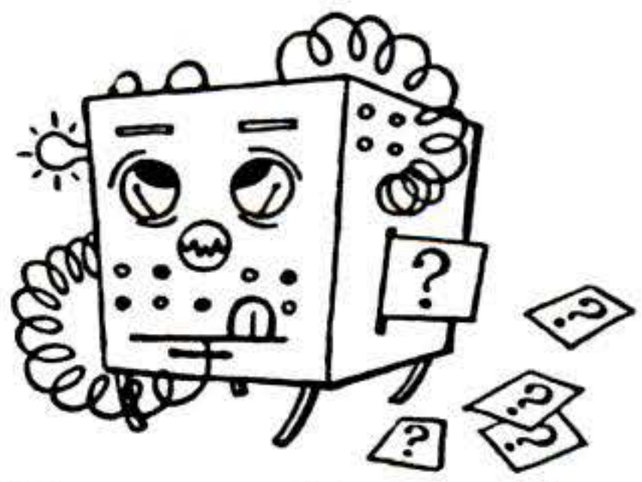
From the look of our nighttime roadscape, I'd say this could be useful. Of course it would kill that famous line: "But officer, it happened just a few minutes ago."

C. A. SPEER, Anna Maria Island, Fla.

Who's a Moron?

READ about those smart electronic robots that are going to take over the intellectual grind ["The Month in Science," Oct.] and was aghast:

"Today computers are morons . . . The



new intelligent machines will not need instructions" or "even need to know precisely what the job is." What does that make *me?*

Then I turned the page: "Perceptron learned to tell right from left after only 100 trials." Now I feel fine.

R. E. WEST, Passaic, N. J.

String Wrap for Leaks

USING cotton string to stop leaks in sink fittings ["Budget Savers," Sept.] is a good dodge, but you might add a point: Coat the pipe threads and the string with the grease used on automobile water pumps. This greatly improves the joint and retards corrosion.

H. C. APPLEGATE, Troy, Ohio.

Breathing Back a Life

I HAVE used the mouth-to-mouth technique of resuscitation ["The Month in Science," Aug.] on infants, but I question whether the mouth can be made to cover both the nose and the mouth of a child of any great size. A mask to eliminate intimate mouth-to-mouth contact has been developed at the Rosewell Park Memorial Institute, Buffalo, N. Y. and its use also simplifies resuscitation of larger persons.

B. C. GWINN, M.D., Athens, Pa.

. . . You say mouth-to-mouth breathing is superior to manual techniques of life-

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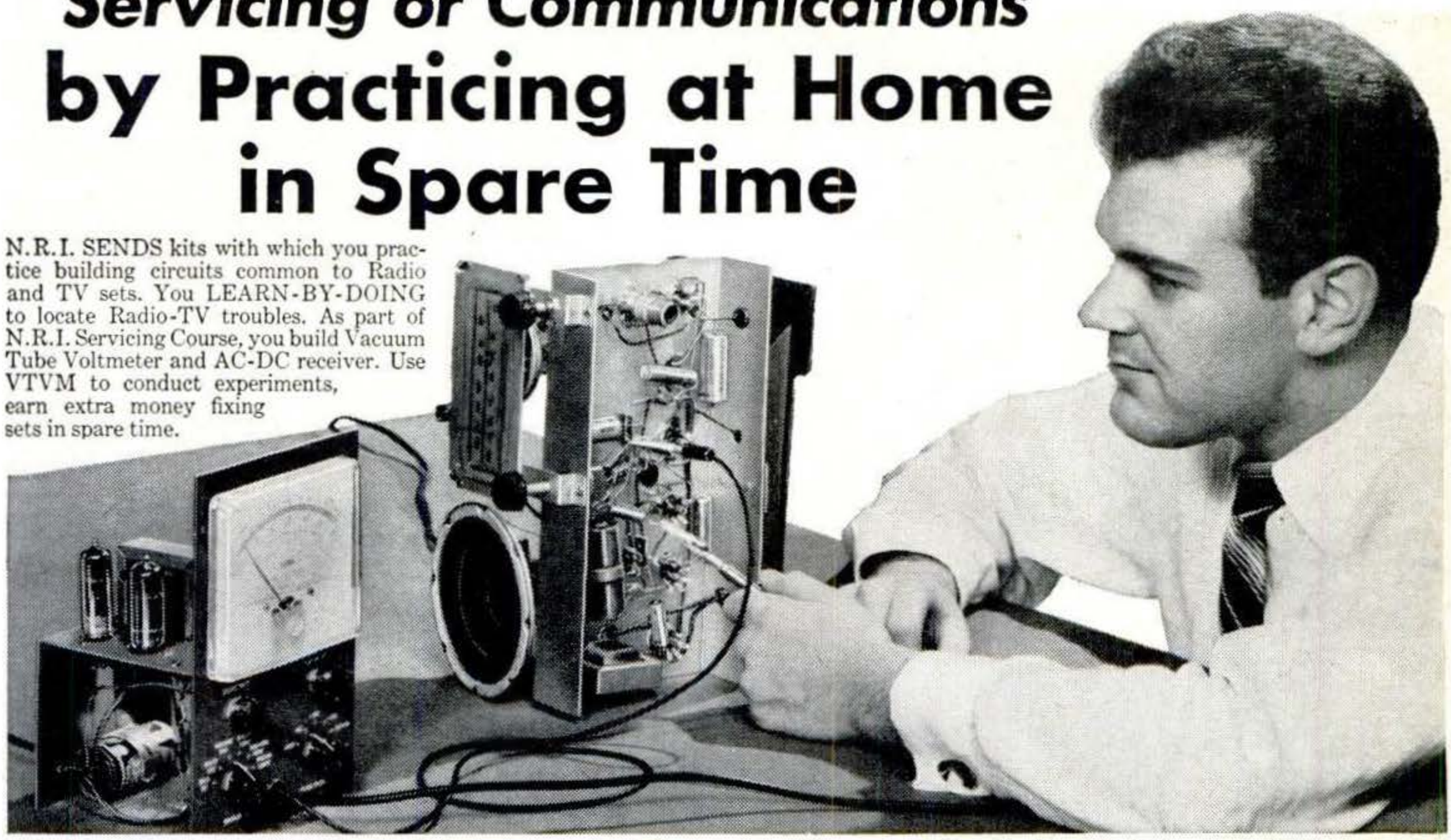
by Practicing at Home in Spare Time



N.R.I. SENDS kits with which you practice building circuits common to Radio and TV sets. You LEARN-BY-DOING to locate Radio-TV troubles. As part of N.R.I. Servicing Course, you build Vacuum Tube Voltmeter and AC-DC receiver. Use VTVM to conduct experiments, earn extra money fixing sets in spare time.

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"There are a number of NRI graduates here. I can thank NRI for this job." JACK WAGNER, Lexington, N. C.

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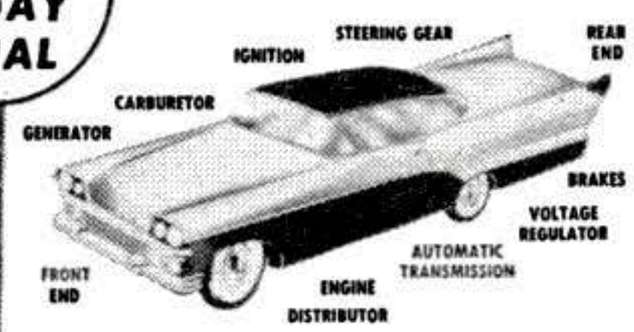

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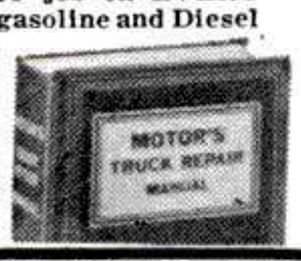

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saving. I can understand how this might be true in cases of suffocation or electrical shock, but how does this method get rid of water in the lungs of a drowning victim? Certainly the "pat him firmly on the back" step is not necessarily going to do a very thorough job of this.

R. N. JONES, Reading, Mass.

Death by drowning is *suffocation. In describing manual artificial respiration, the* Encyclopedia Britannica *says: "The rescuer should not attempt to remove water from the lungs, but should give artificial respiration at once."*

Pro Okays Long-Distance Dialing

I ENJOYED "Do-It-Yourself Long-Distance Dialing" [Sept.]. I have spent 35 happy years with the N.Y. Telephone Company and, as a switchman, it is my pleasant duty to maintain the dialing equipment covered so well by Don Wharton.

W. J. ALBERT, Freeport, N.Y.

The Constant Screwworm

SOUNDS like the Government is screwier than the screwworms they're trying to make commit race suicide ["The Month in Science," Oct.]. After they catch them, they sterilize them with atomic rays and release them. Once they've got 'em, wouldn't it be simpler to stop fooling around with rays (and my tax money) and just stomp on them? That way there wouldn't be any baby screwworms either.

J. T. JACKSON, Newark, N.J.

Ah, but they can't catch all the males. And remember, the female mates one time only, and after she accepts a sterile mate, no untreated male interests her.

Small-Car Fans Ride Again

NEXT time I buy a car, it will be a Volkswagen—or the simplest practical car I can find. I happen to be one of those Joes—a salesman by occupation—who needs a car but can't change a spark

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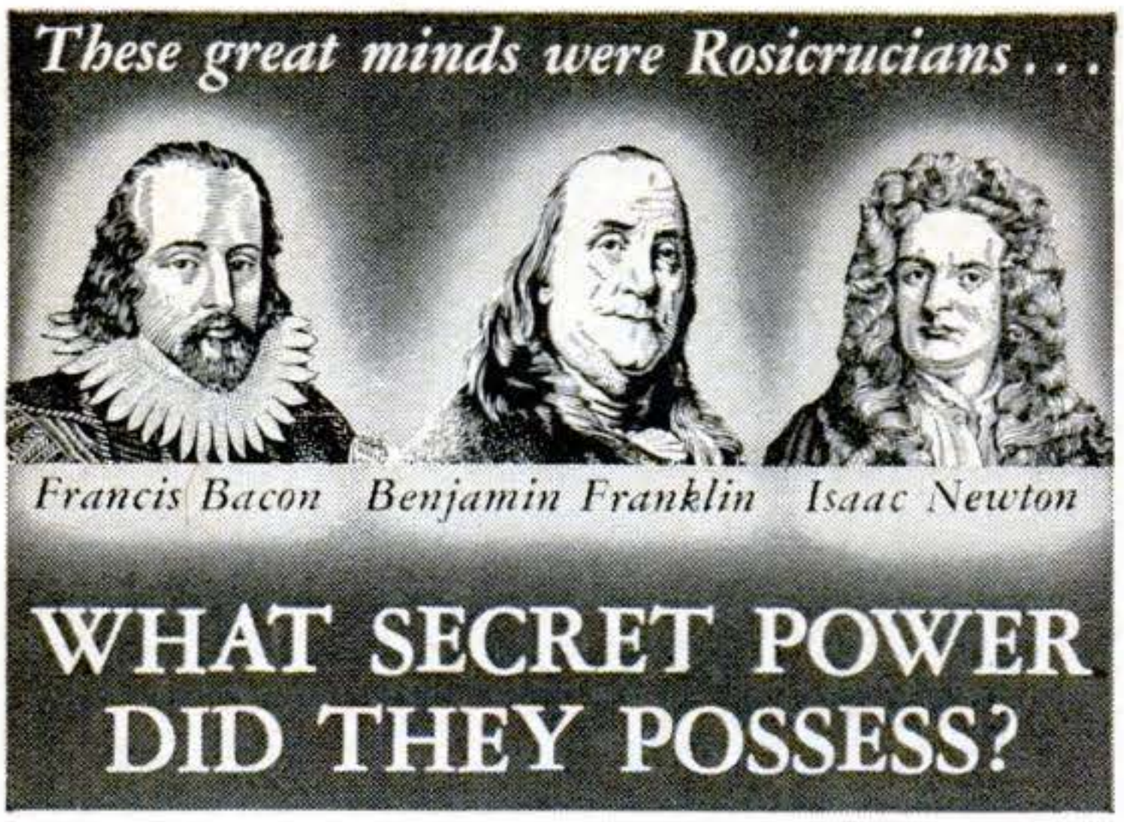

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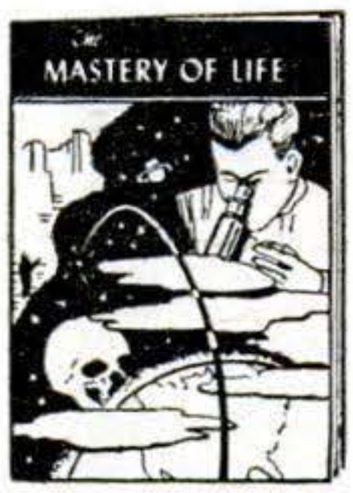

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plug. What happens to a guy like that?

He buys the 1958 output of one of the Big Three that looks swell on the showroom floor and later he finds out what he's got: a monstrosity that demands superpremium gas, carries a four-barrel carburetor that needs semimonthly adjustment and gives him a big 10 m.p.g. This he needs! He's got a 10.5:1 compression ratio that eats up a set of plugs every 5,000 miles. And he's got four mufflers (okay, so two of them are called resonators). This, too, he needs!

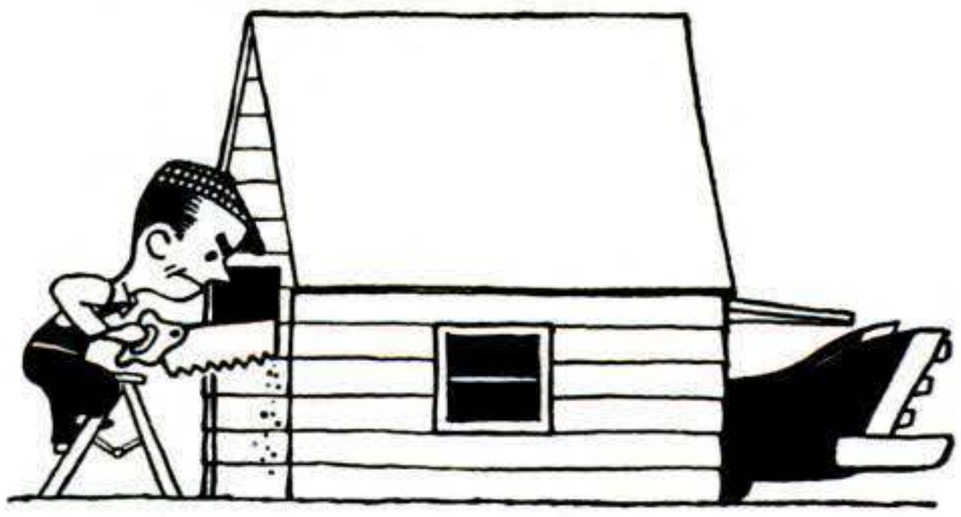
What he's *really* got is a headache, and admittedly it's his own fault. But this Joe "ain't going to do it again."

A. R. August, Englewood, N.J.

. . . In all the talk about the reasons for the influx of small foreign cars, nobody mentions the forgotten Americans. These come in three varieties:

1. People who were satisfied with the economy of the old, smaller cars, and were compelled to turn to imports.

2. People who live in old cities with narrow streets and tight turns.



3. People who liked the larger cars but couldn't (or wouldn't) lay out cash to alter old driveways and garages.

H. Wayne Moyer, Forest Hills, N.Y.

Award News Reaches Africa

Congratulations on having won the Benjamin Franklin Award for your series "Straight Talks to Parents."

I am a member of the American Library, operated by the U.S. Information Service at Nairobi. Some time back they lent me the March '57 issue which carried the first article, but I have been unable to get the later ones. Are reprints available?

Gulam Hussein Dhanidina,
Nairobi, B.E.A.

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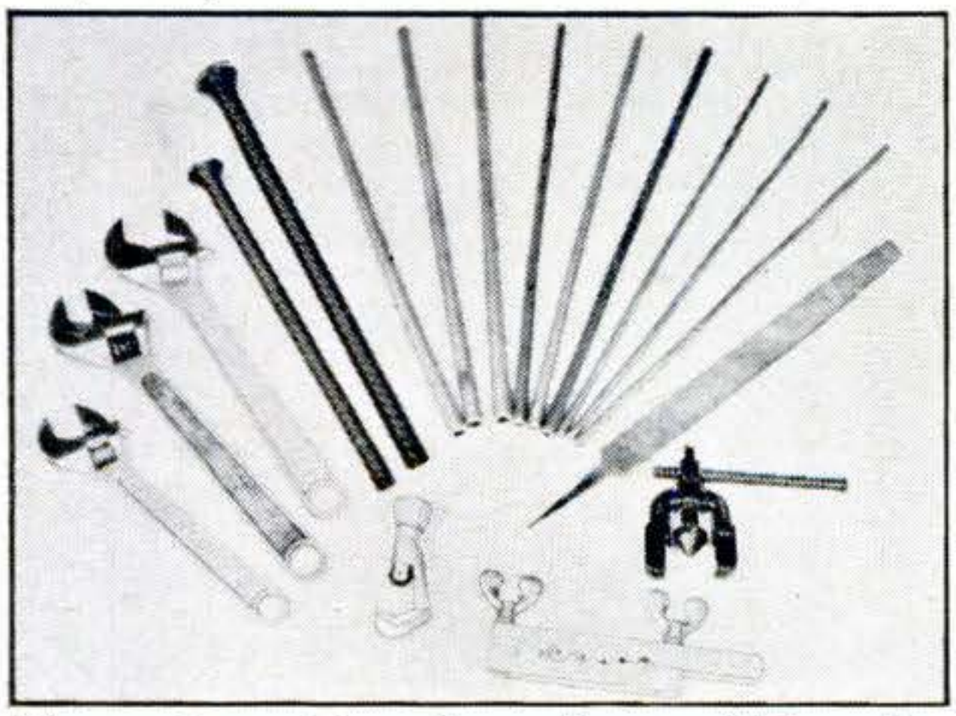

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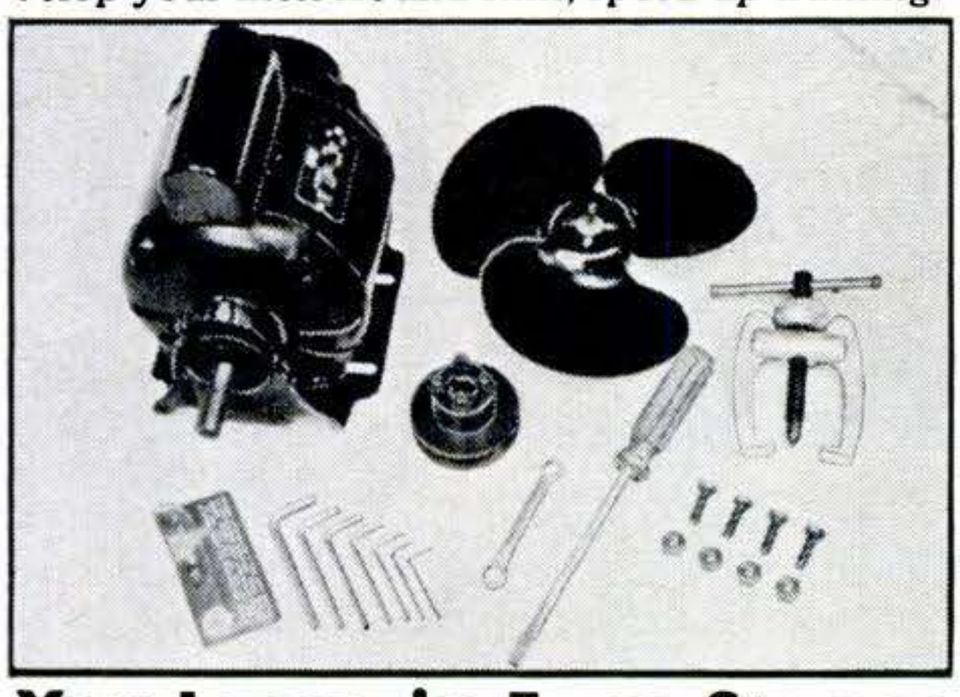

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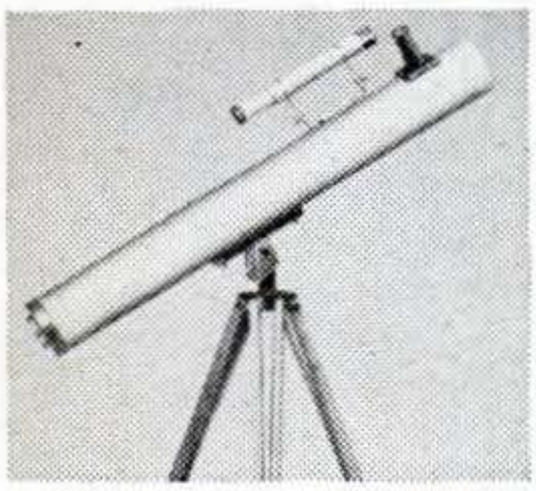

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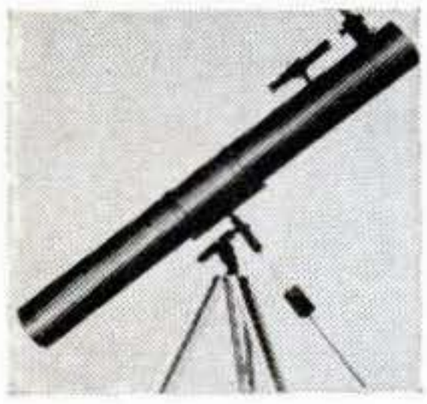

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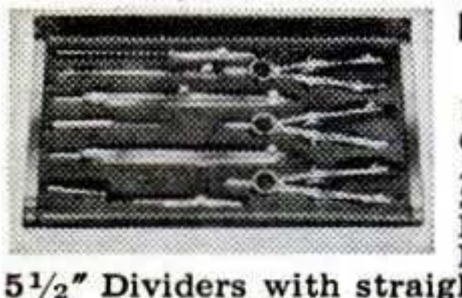

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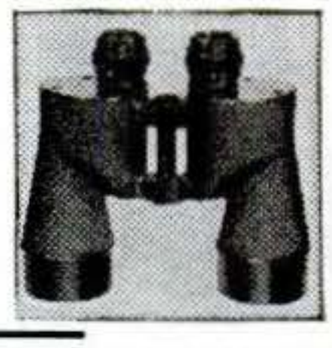

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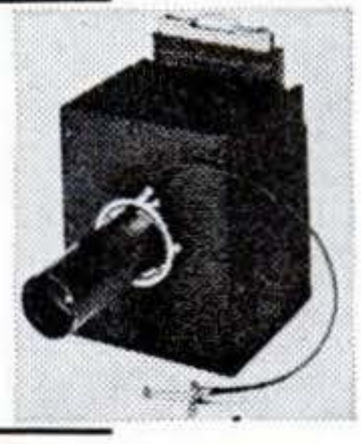
TELESCOPE CAMERA



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The month in science

Rockets, gravity and space. Even the all-knowing U.S. Air Force gets mixed up occasionally on space facts (as it did last fall, when Pentagon press agents bloopered that the Pioneer moon rocket "escaped the Earth's gravitational field"). No wonder ordinary untechnical citizens go glassy-eyed when terms like escape velocity and apogee are thrown at them. Here are the hard facts of moon travel:

How far out does gravitation go? On and on and on. The Earth's attraction decreases as you get farther from its center, following the "inverse-square law." At 4,000 miles altitude it is one-fourth as great as at the Earth's surface, at 8,000 miles one-ninth as great. It never gets to zero—but between Earth and moon (216,000 miles up) is a point of no return, where the moon's gravitational force becomes greater than the Earth's.

How can you escape gravity? Blast off Earth so fast that your momentum keeps you going forever (or until some other gravitation catches you). The backward pull of Earth's gravitation always slows you down, but less and less as you get farther and farther away, so that it never quite overcomes the forward momentum. This escape velocity is 25,000 m.p.h. (for a start from the surface of Earth). Once you hit that speed, you are free of the Earth and can coast forever.

Are such fantastic starting speeds necessary for space travel? No. A slow, steady thrust of power, just enough to keep the rocket rising, but continuous during the trip, would work as well, scientists say. This may be possible with atomic engines [PS, Oct.]. But with present rockets, which soon burn out, the only practical method is to start like a jack rabbit, then coast the rest of the way.

Would a rocket take a direct path to the moon? Or would it spiral out, circling with the Earth's daily rotation? The course is direct, and not a spiral. Here's why: The firing is timed so that the Earth slings the rocket off *toward* the moon. That way the Earth's rotational velocity adds to the rocket's velocity and helps it along on its course.

How come space vehicles don't burn up on ascent, yet do burn when they fall back to Earth? Acceleration is slow at first, so that the rocket does not hit top speed until it has left the Earth's dense atmosphere. The situation is different on the return. Then the rocket falls faster and faster as it gets closer to Earth. It is at top speed when it hits the dense air, and friction burns it up.

A new plastic is bouncing into your life. The name is urethane (rhymes with you're a pain). It's been around for a while, mostly as padding of one kind or another (see PS, Aug., for around-the-house uses), but development of a new formula—cheaper and better—has now kicked off big-scale production.

Behind urethane's promise is its amazing ability to assume almost any form you want. It can be paint, glue, solidified foam (light or heavy, soft or rigid), rubbery plastic. Doctors even use it

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to cement broken bones together so that patients can discard crutches sooner. The urethane is harmless, and is gradually dissolved by the blood as the fracture knits.

The lightweight, soft foam is now getting a big play commercially as a replacement for foam rubber. You'll feel it soon in new sofas, mattresses and car seats. Urethane's advantages:

- It gives, soft as a cloud, but doesn't bounce back the way latex does. This is essential for safety padding in cars, also makes mattresses and cushions feel more comfortable.
- It is lighter than latex (by a third).
- It doesn't slip inside fabric covers.
- It is very strong—you can stitch it and it won't tear.
- It is tough: fire-resistant, unharmed by washing or dry-cleaning.
- And the big thing: It is often cheaper than latex.

Main disadvantage so far: trouble with the molding process. Urethane foam now comes in slabs, which are cut to size, leaving flat surfaces and sharp edges. Crowned, rounded-edge shapes—latex is available that way—would be better for cushions.

Other properties of urethane give it the job-winning edge in a strange assortment of uses. For instance:

- Clothing. Urethane is such a good cold-stopper, and so light in weight, that it makes an excellent lining for coats, jackets, even kids' snow pants.
- Paint. A deck paint made with urethane is so tough that spiked golf shoes don't scratch it. Permanently scratchproof furniture finish is another possibility.
- Tires. Urethane has five times the abrasion resistance of rubber. Experimental tires lasted 100,000 miles—the life expectancy of a car. And urethane heels should still look new when the shoes are worn out.
- Insulation (refrigerators, house walls). Important here, besides cold-stopping and light weight, is the "foam-in-place" technique. You can mix the chemical powders with water and actually manufacture the insulating foam right in the space to be insulated—the hollow inside a refrigerator door, for example. The stuff foams up and sets in a few minutes, precisely filling the cavity. The method is already used to fill buoyancy chambers in "unsinkable" boats.

Asian flu again. Watch out for influenza this month. Experts at the U.S. Public Health Service expect it to reappear about now, but only in specific local areas, not nationwide. It won't be as severe, either, as the epidemic last year, which sent 80,000,000 aching people to bed and nudged the overall death rate up.

Martin Mann

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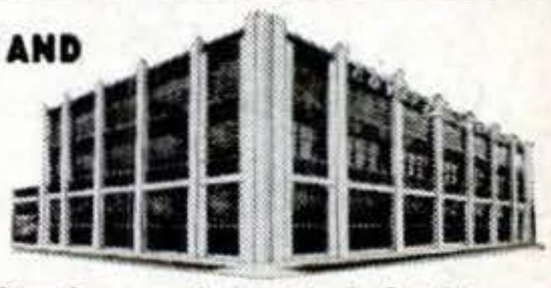

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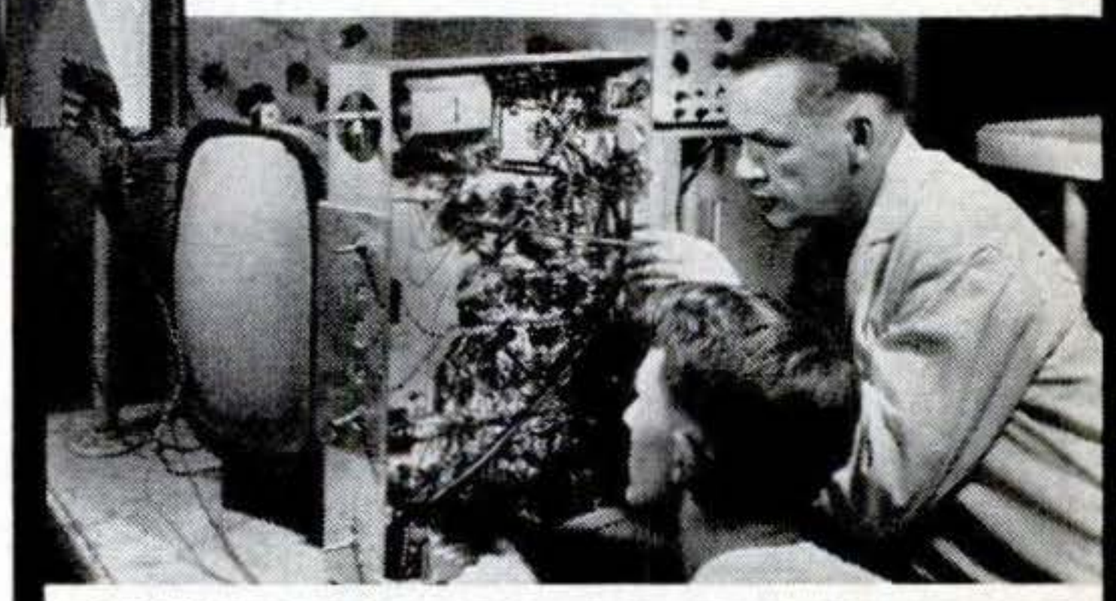

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You ought to know...

Was your car-insurance tab "packed"? If so, money may be due you—as much as $125 if you stretched payments over three years. The pack rated you a Class II risk—the penalty rate for young drivers. You paid 35 percent too much if no one in your family is under 25.

Congress cracked down on this racket a couple of years ago when it got wind of heavy company profits—reaped particularly by auto insurers tied in with finance companies. A look at some books showed 80 percent and more auto owners classed as high risks—figures that don't jibe with a nationwide average of 15 or 20 percent of drivers in this group.

Red-faced officials did a feeble refunding job. Of the $25-million rake-in, only $8½ million was returned. Many states were guilty of official cover-ups, insufficient publicity, and gobbledygook form letters contrived to confuse the car owner. Senator Mike Monroney (Dem., Okla.), chairman of the subcommittee on auto marketing, promises a complete wrap-up this session. Pending may be: 1) a look at excess charges in tie-in life-insurance deals; 2) federal rate regulation to curb state laxity.

Take a look at your contract. Best bet if you've been victimized: Contact your local Better Business Bureau.

What's headed your way in '59? Here's what wind-sniffers see for the coming year:

. . . more pushbuttons: Cars sold poorly in '58, but powerfully. Take power steering. A record one out of every three '58s had it. You can expect an even-steven split in '59. Around the corner may be power-operated doors, hoods, sliding tops, even vibrators to wake sleepy drivers.

. . . power mowers: They'll come down in price in '59, with some showing distinct improvement. Lawn-Boy's Quietflite will offer real noise control for the first time, with a shock-mounted engine, fiberglass-insulated hood, enlarged muffler.

. . . new ways with old cottons: You may be able to take 'em to the cleaners in '59 and get them wash-'n-wear treated. The resin-treating process works; what remains are some economic wrinkles.

. . . improved synthetics: A new variety of Dacron can combine with heavier fibers for wash-'n-wear winter suits . . . Competing with old Dacron next spring will be Kodak's new lightweight synthetic, "Kodel." The polyester fiber has the usual quick-dry, wrinkle-resistant features plus higher heat resistance.

. . . new lamps for old: Your tear-drop bulbs may be gone if lamp men have their way. In their place: barrel shapes. Incandescents will have greater glare-resistance, more color. Electroluminescent (panel) lighting, dribbling to market in the past few years in the form of radio and clock faces, will try for a greater splash in '59. (A phosphor layer sandwiched between the plates of a condenser converts the electricity stored by them directly to light.) Westinghouse will sell a plug-in night light that lies flat against the wall and will run for about a year on less than a penny's power. Sylvania E-L may appear on dashboards

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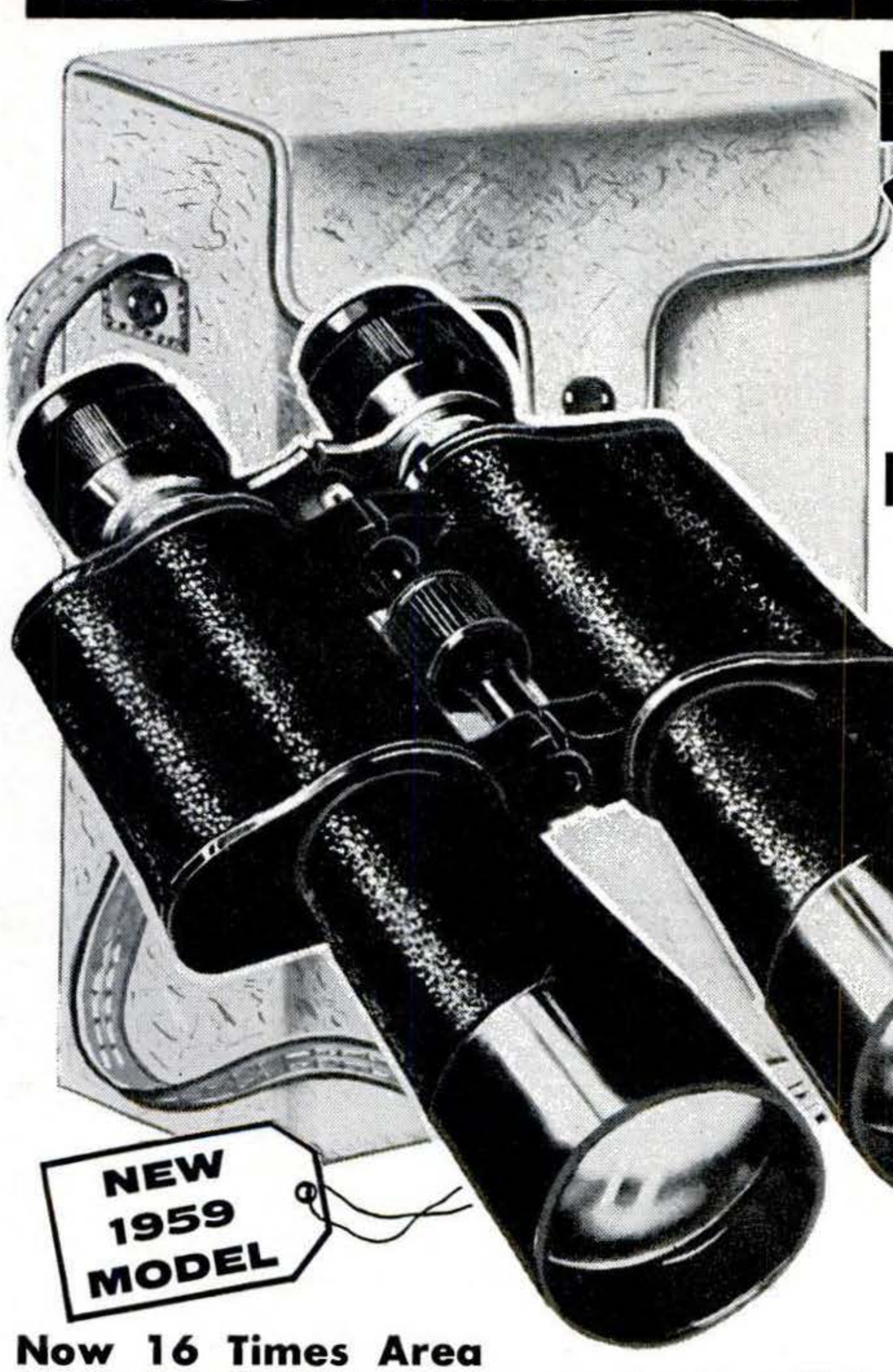
50 MILE VIEWS



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You ought to know...

of '60 models for one of the Big Three—eliminate a score of miniature bulbs. In the offing: E-L picture windows and drapes regulated for color by a dial.

. . . foaming aluminum: Trapped air bubbles in metal will help it outfloat wood.

. . . painless tooth-filling: Experimenters are pouring a liquid plastic into cavities these days. It sets in a few seconds, needs no prior drilling.

. . . Americanized wine: California wine-growers say there's nothing wrong with their pressings except that Americans don't drink wine. They're playing around with secret herb flavors and extracts (mainly citrus) that'll give a new oomph.

Tiffany's, anyone? For harried husbands faced with Christmas-gift dilemmas, POPULAR SCIENCE offers here its "Compleat Gyde to Diamond Buying":

First advice: Go to a reputable dealer. To judge a stone's value consider these four things (listed in order of importance):

Color

- Your naked eye can't detect "pure whiteness." Dealers color-match new stones against a fixed set, reject all but top grades. Color tinges greatly decrease value.
- Beware the "blue-white" label. It's meaningless.
- To get some idea of color, look at the stone on its side (too many facets on top distort). Hold it over white paper, use north light, free from sun.

Perfection

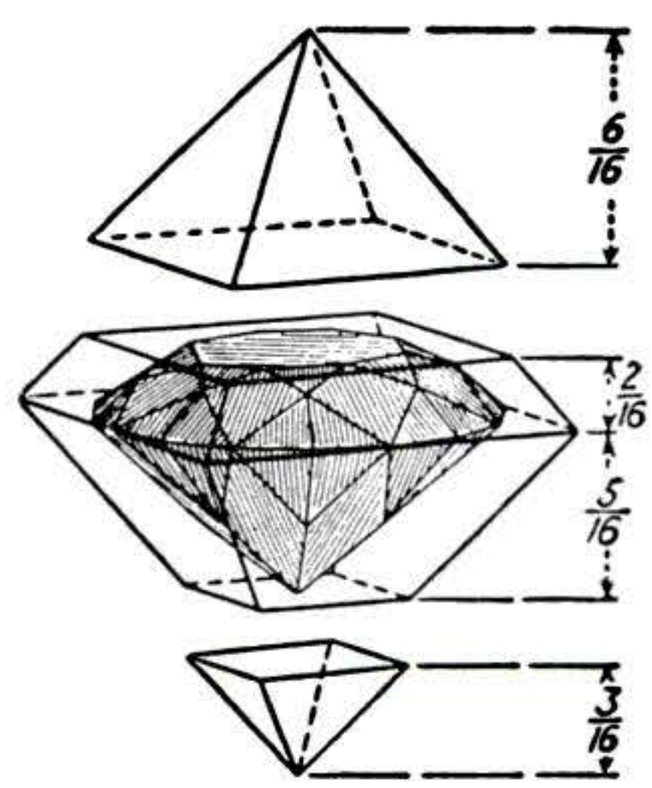
- You can't judge flawlessness unless you use a jeweler's loupe—the familiar magnifying eyepiece. If a stone passes 10-power loupe inspection it's called "perfect."
- Deviations are ranked according to location, depth and color. Light scratches near the edge are not as serious as carbon spots near the center.

Cutting

- A well-cut diamond should glitter—good cutting helps it reflect a maximum of light. Craftsmen smooth and polish, remove flaws, try to sacrifice as little weight as possible. (The weight of the stone is measured in carats: 1 carat=.2 gram; 1 point=.01 carat.)
- Round-cut diamonds have 58 facets. Other cuts may have more or less. Remember: For the same weight, some shapes (pear, marquise) will look larger.

Proportion

- There should be a balance in the way a stone is cut relative to its size and thickness. Illustration shows correct proportion for a round-cut.



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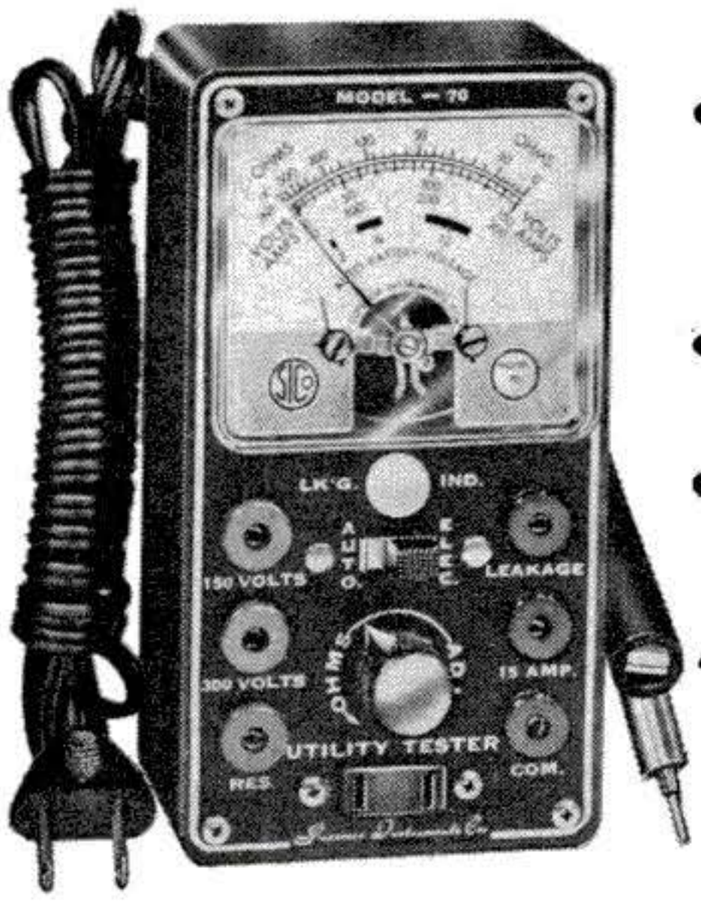

As an electrical trouble shooter the Model 70:

- Will test Toasters, Irons, Broilers, Heating Pads, Clocks, Fans, Vacuum Cleaners, Refrigerators, Lamps, Fluorescents, Switches, Thermostats, etc.
- Will test *all* TV tubes for open filaments, inter-element shorts, burned out tubes, etc.
- Measures A.C. and D.C. Voltages, A.C. and D.C. Current, Resistances, Leakage, etc.
- Will measure current consumption *while the appliance under test is in operation.*
- Incorporates a sensitive direct-reading resistance range which will measure all resistances commonly used in electrical appliances, motors, etc.
- Leakage detecting circuit will indicate continuity from zero ohms to 5 megohms (5,000,000 ohms).

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• Both 6 Volt and 12 Volt Storage Batteries • Generators • Starters • Distributors • Ignition Coils • Regulators • Relays • Circuit Breakers • Cigarette Lighters • Stop Lights • Condensers • Directional Signal Systems • All Lamps and Bulbs • Fuses • Heating Systems • Horns • Also will locate poor grounds, breaks in wiring, poor connections, etc.

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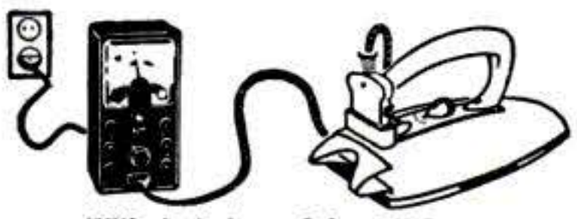
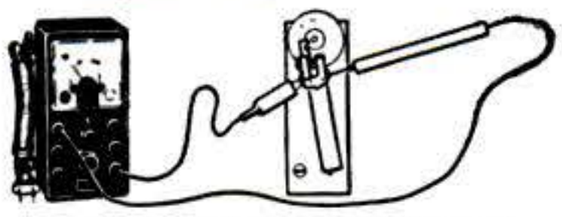
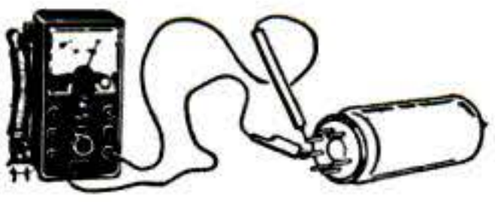


With tester's cord in outlet, current consumption of appliance is read direct on meter when line cord is connected to receptacle on panel. This typical iron takes 7 amperes (Good).

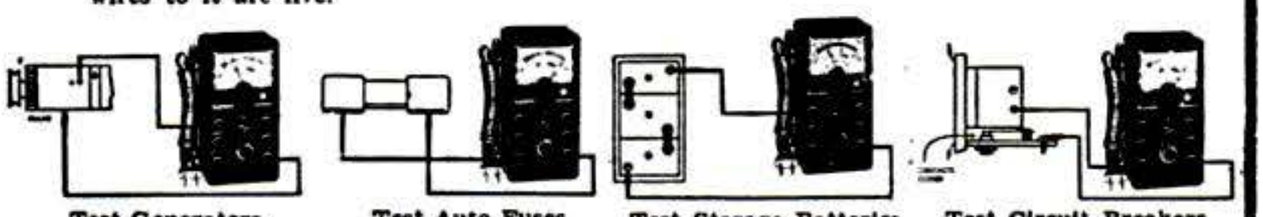
Small electric fan motor indicates 50 ohms (normal resistance).



Control circuits of most furnaces use 24 volts obtained from step-down transformer. Here's how to check room thermostat to see if wires to it are live.



Manual supplied with Model 70 shows meter needle moves to right when test leads are connected to pins 3 and 4 of this 6AU6 tube. Procedure for testing all tubes used in TV are detailed in manual.



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• How to test all TV tubes; also simple procedure for determining which specific tube (or tubes) is causing the trouble.

• How to trace trouble in the electrical circuits and parts in automobiles and trucks.

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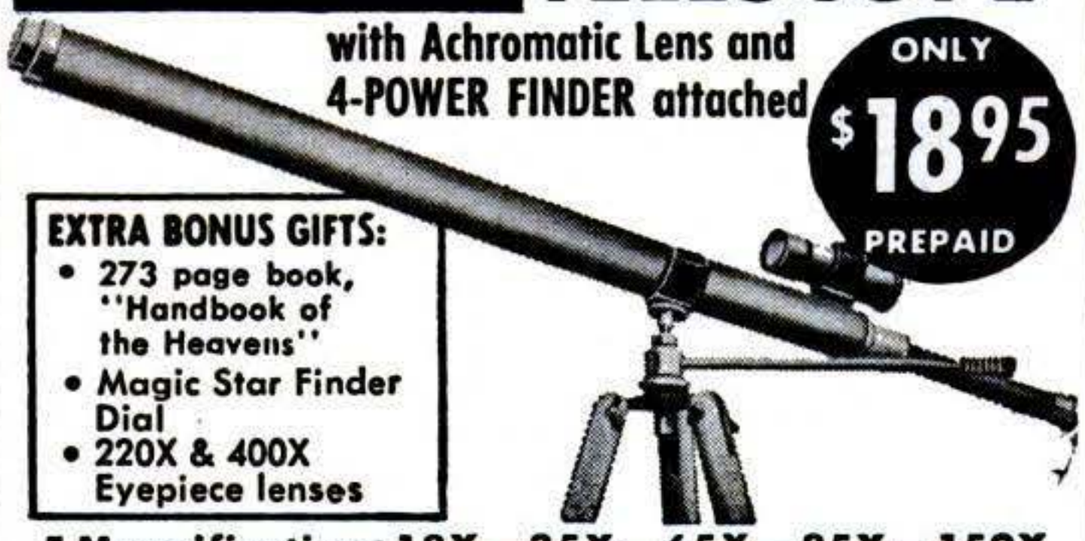

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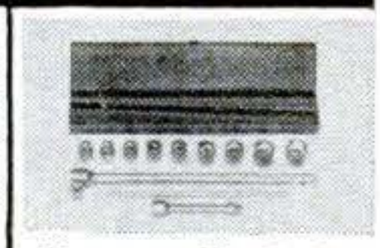

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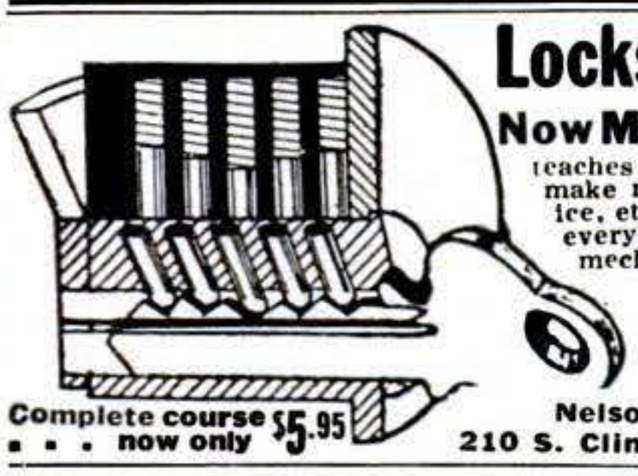

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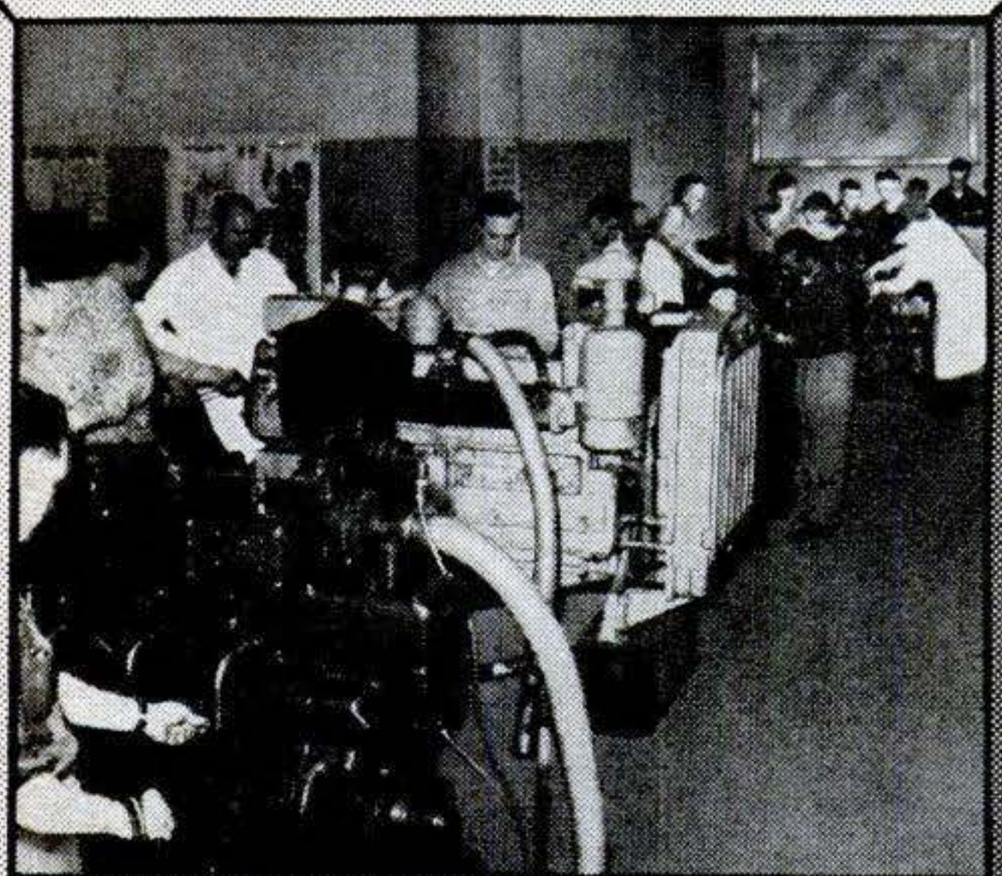

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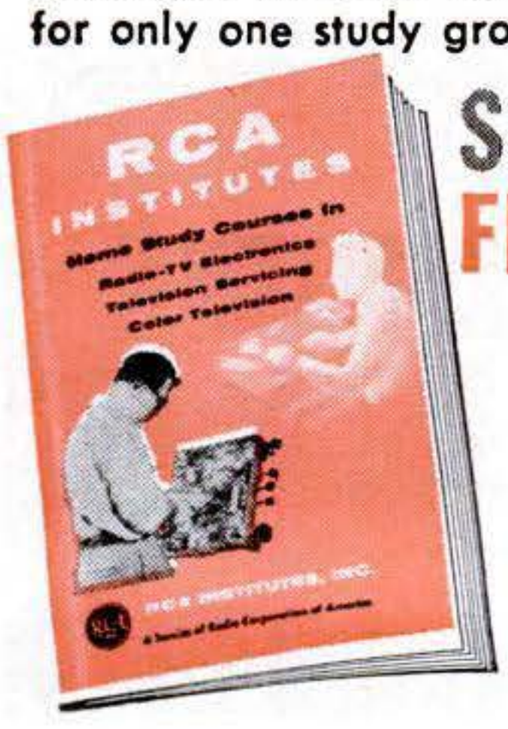

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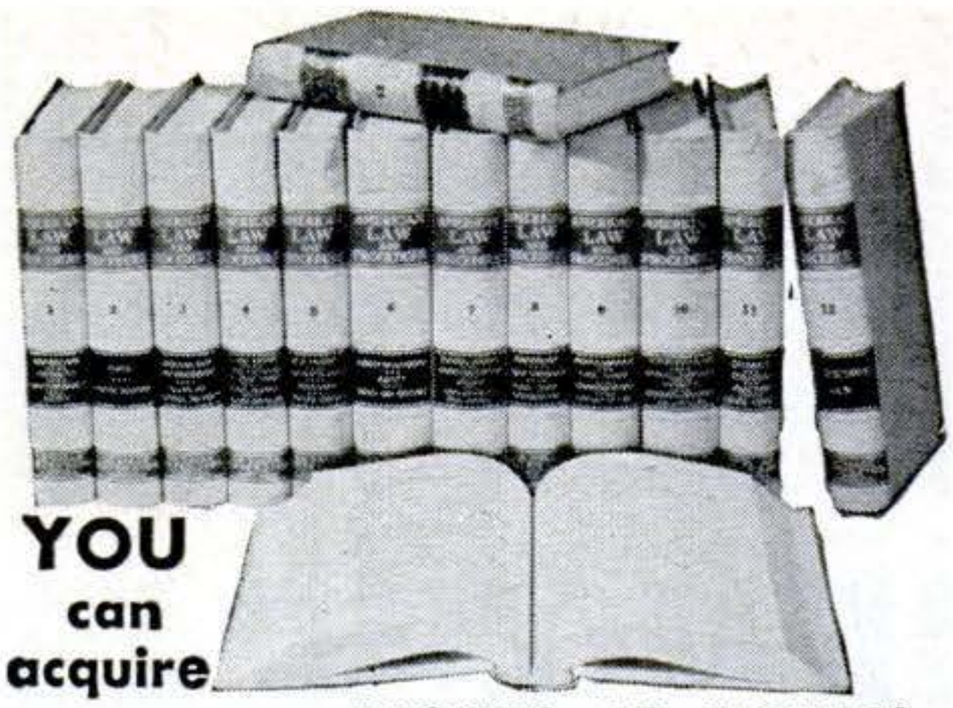

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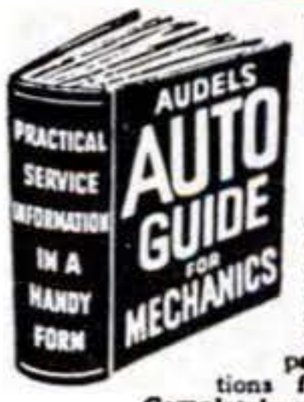

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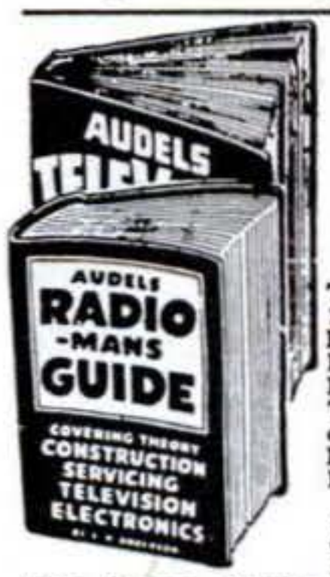

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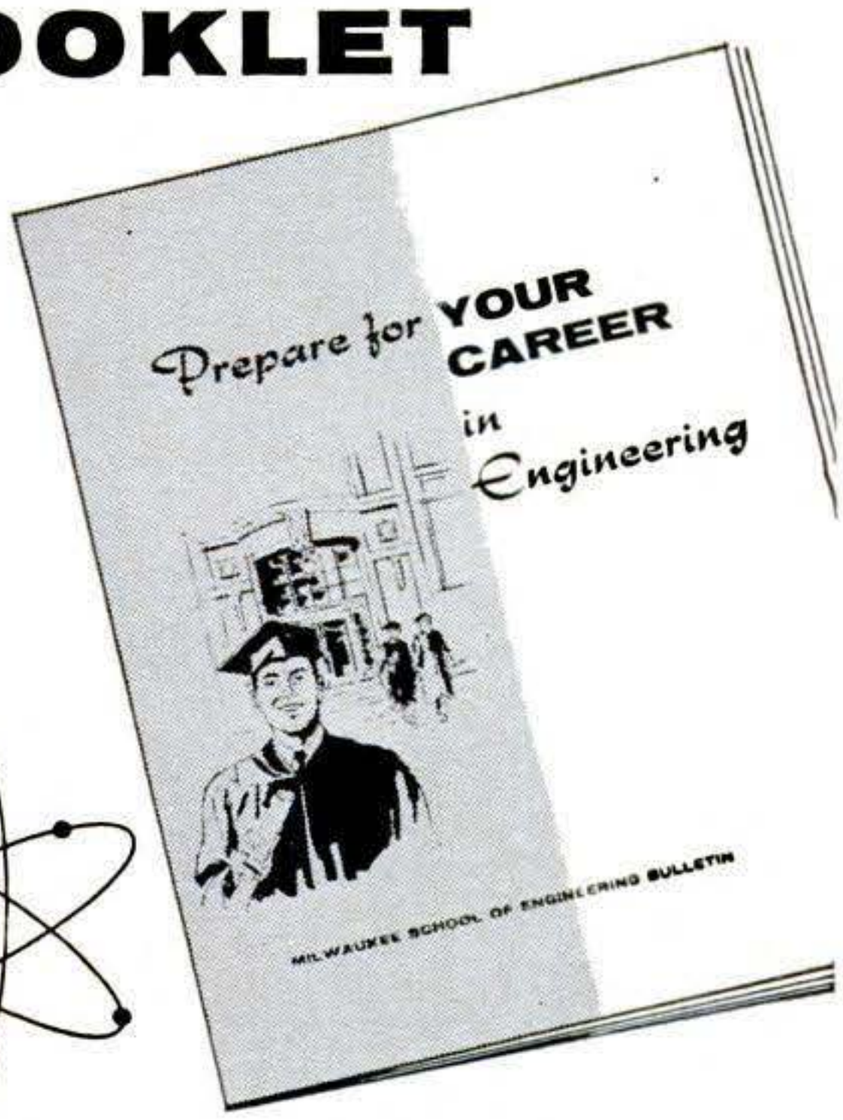

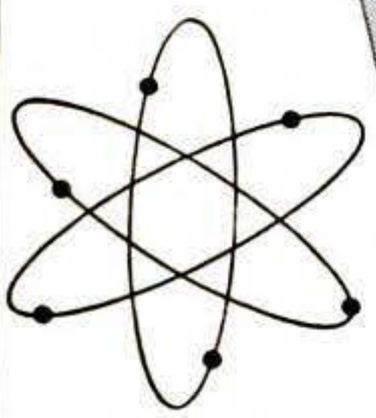

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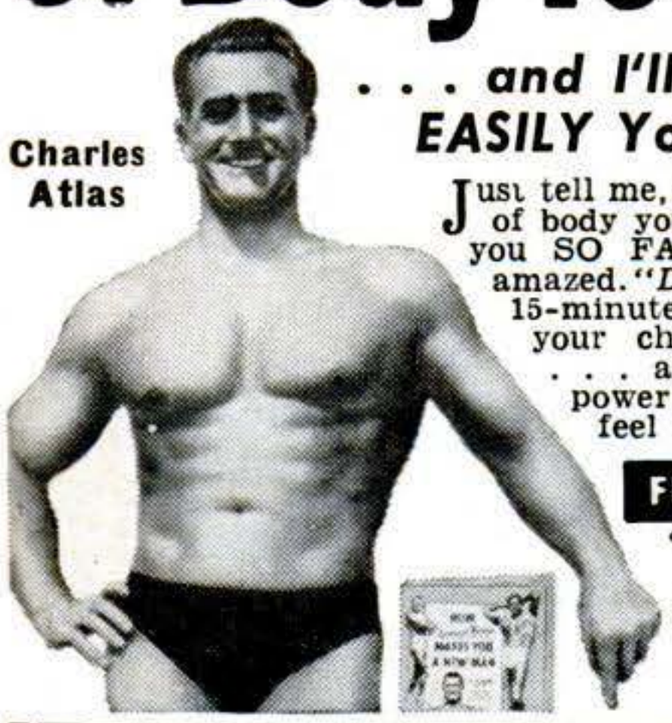

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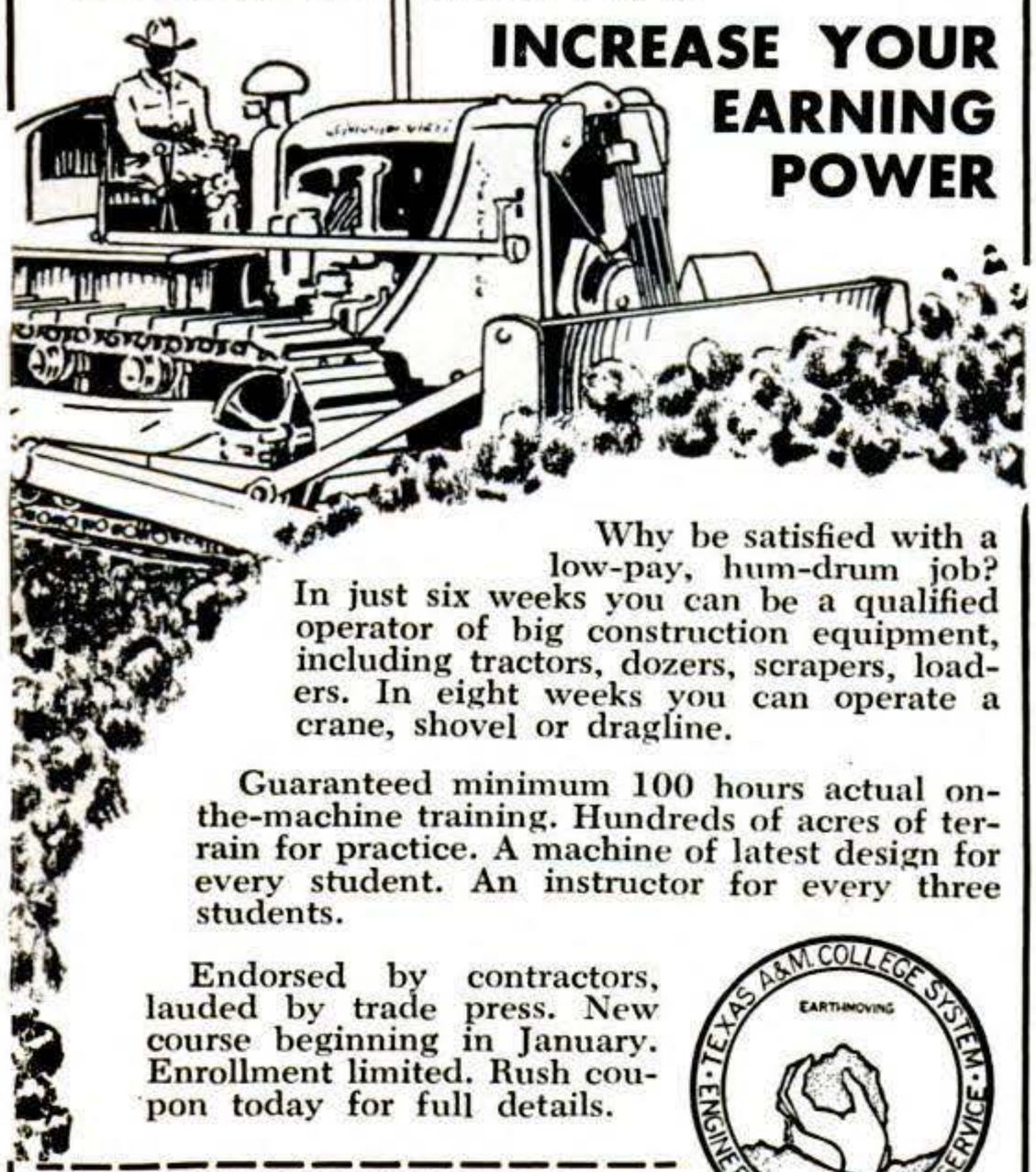

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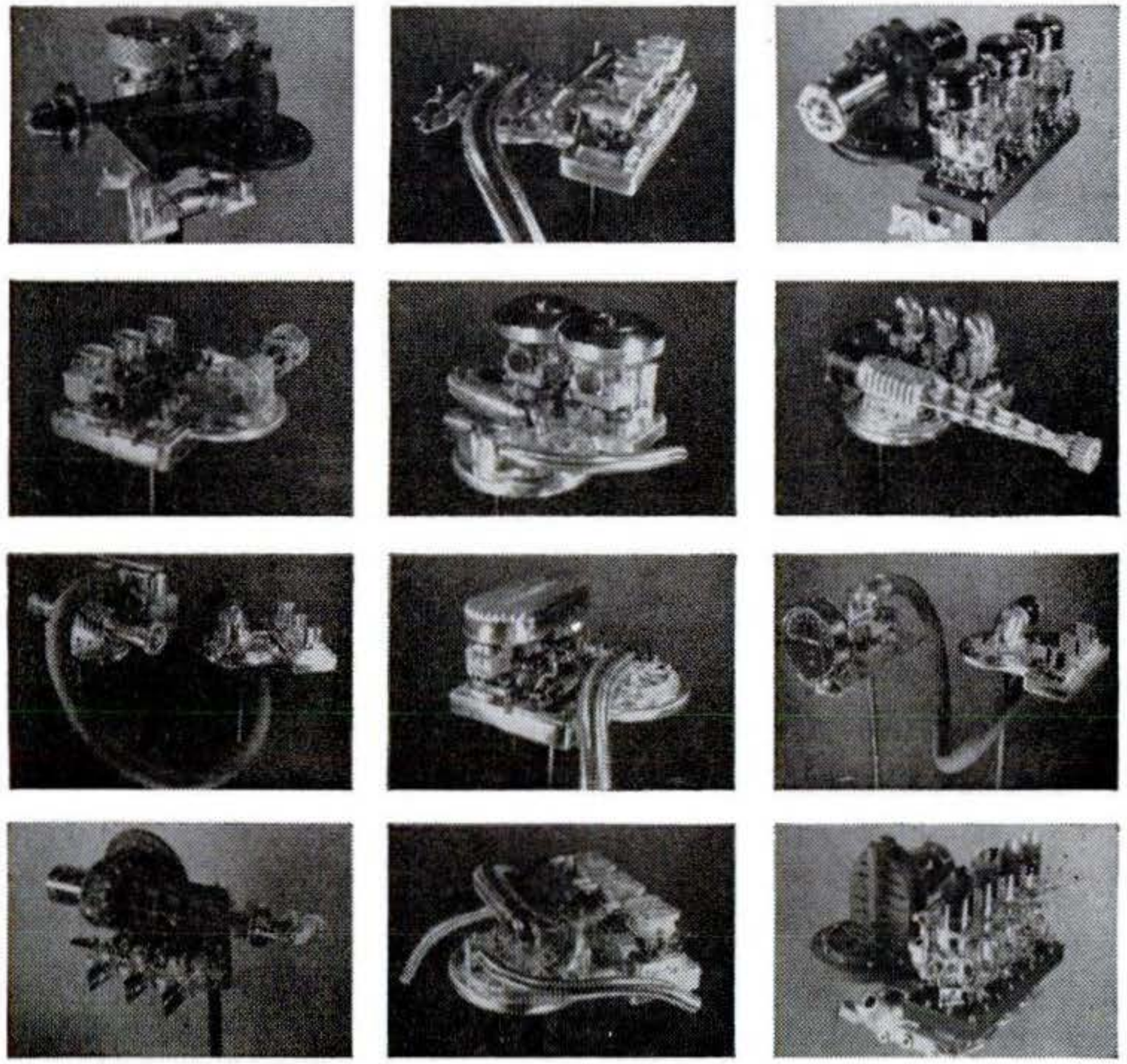

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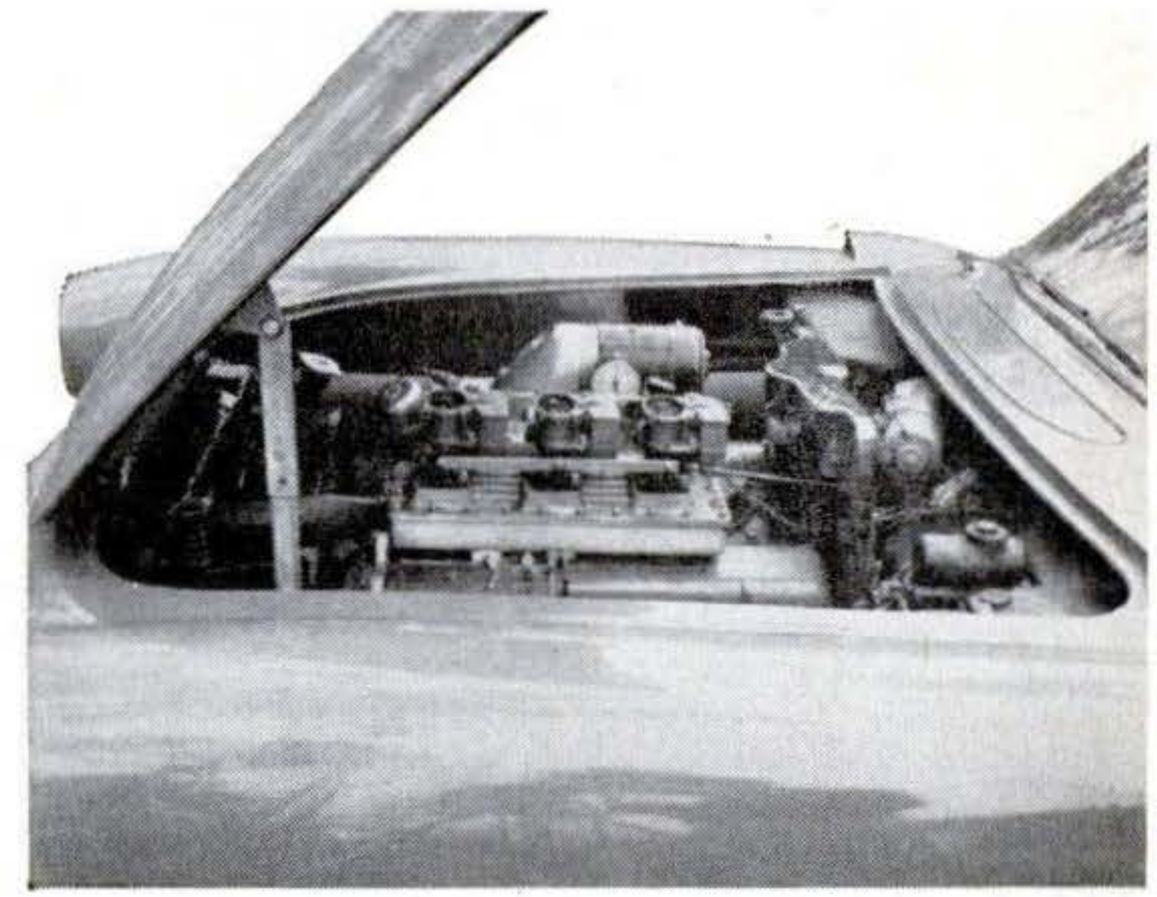

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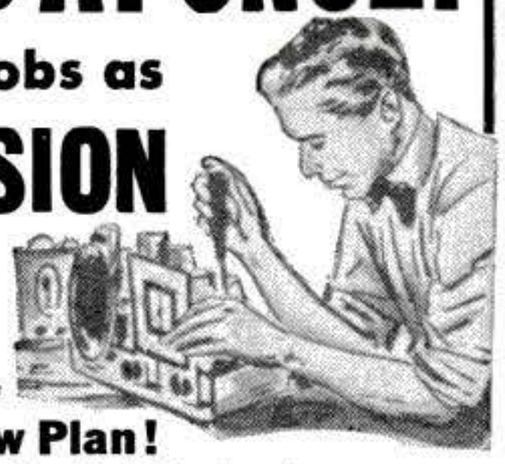

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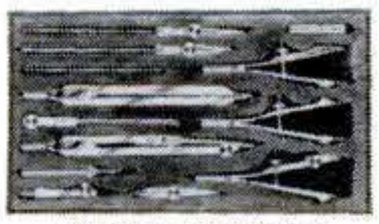

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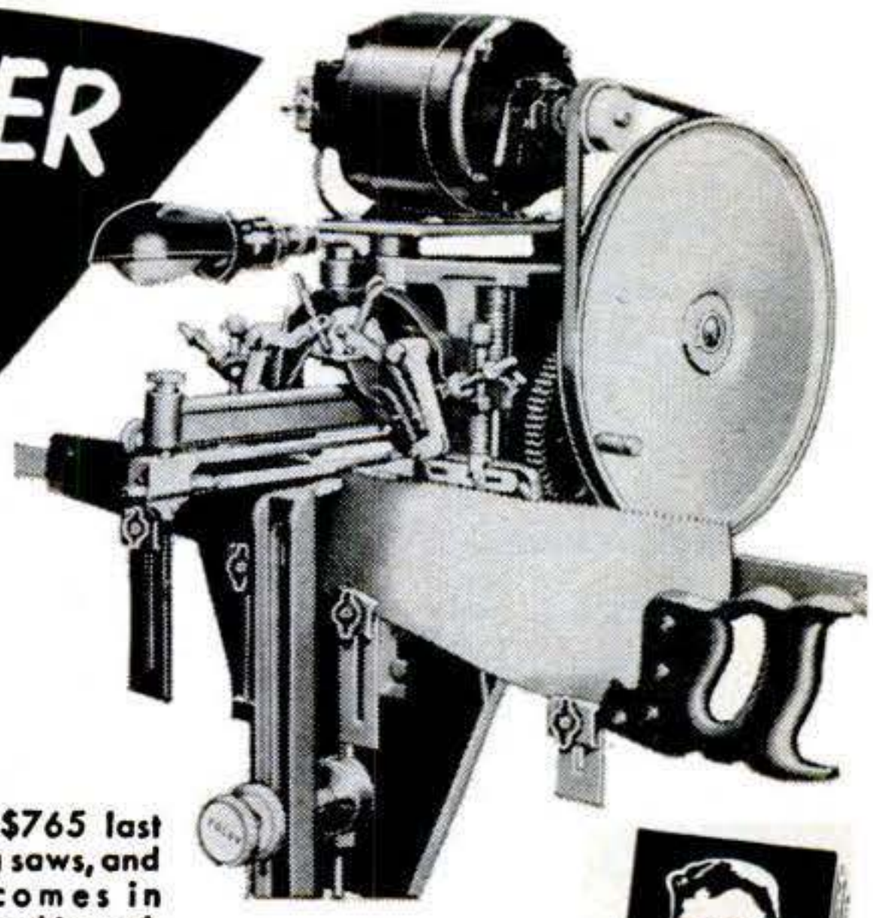

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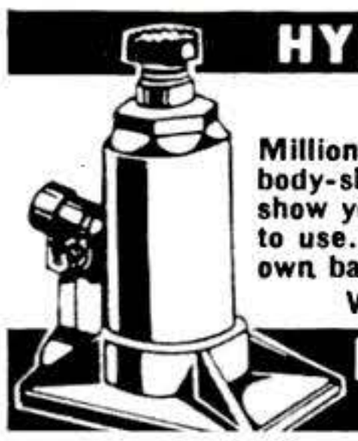

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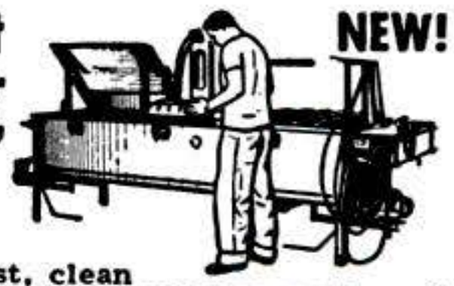

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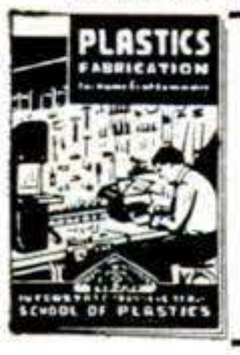

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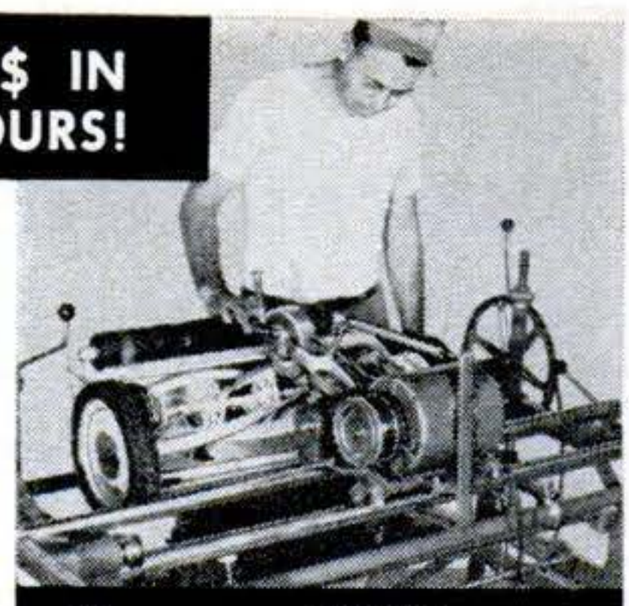

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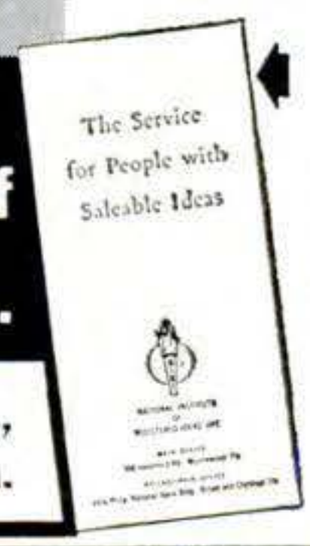

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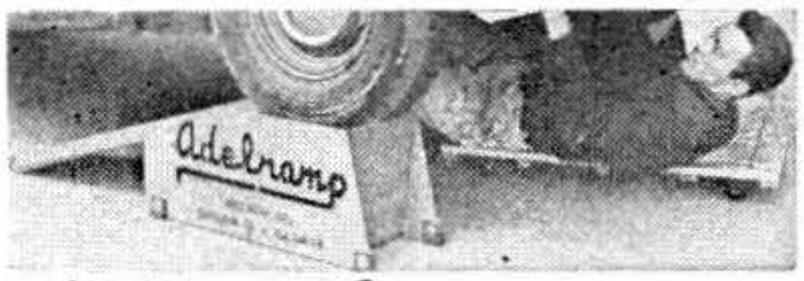

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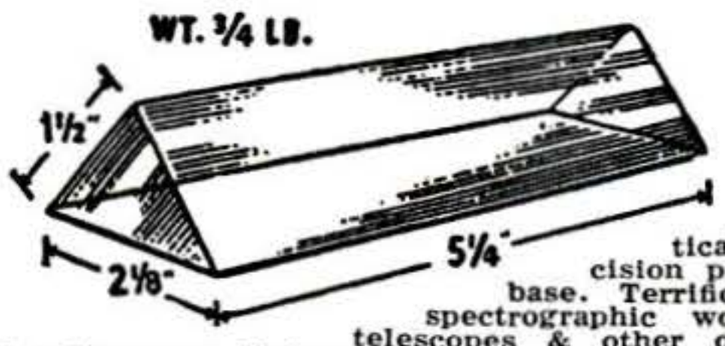

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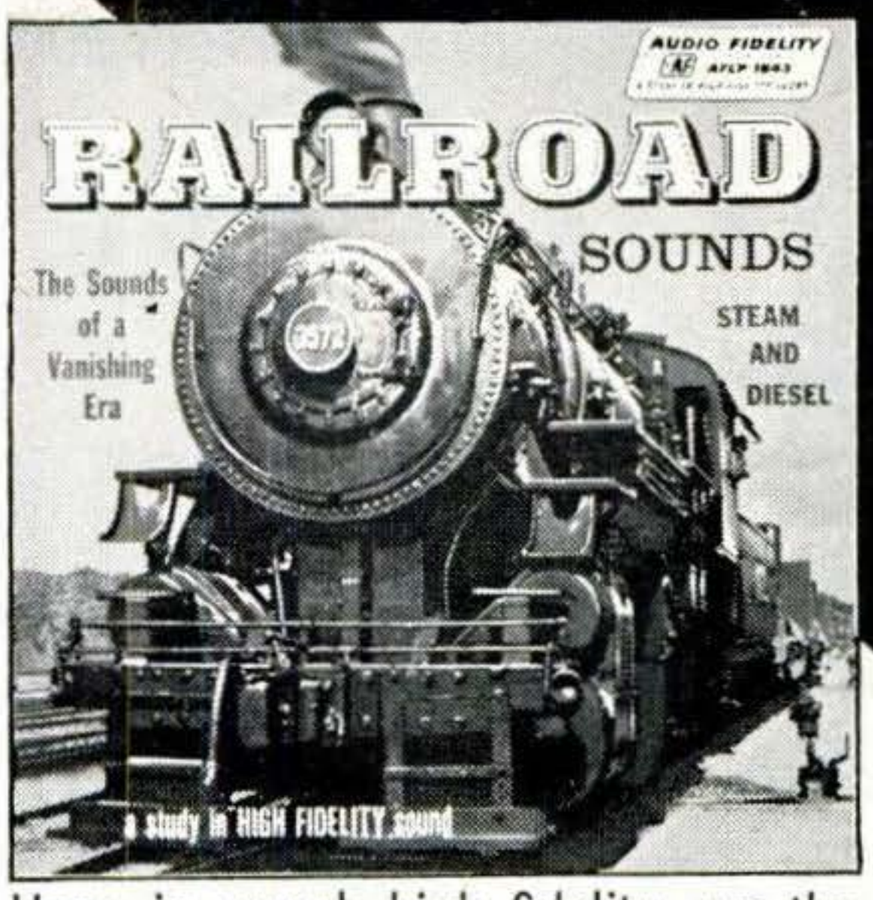

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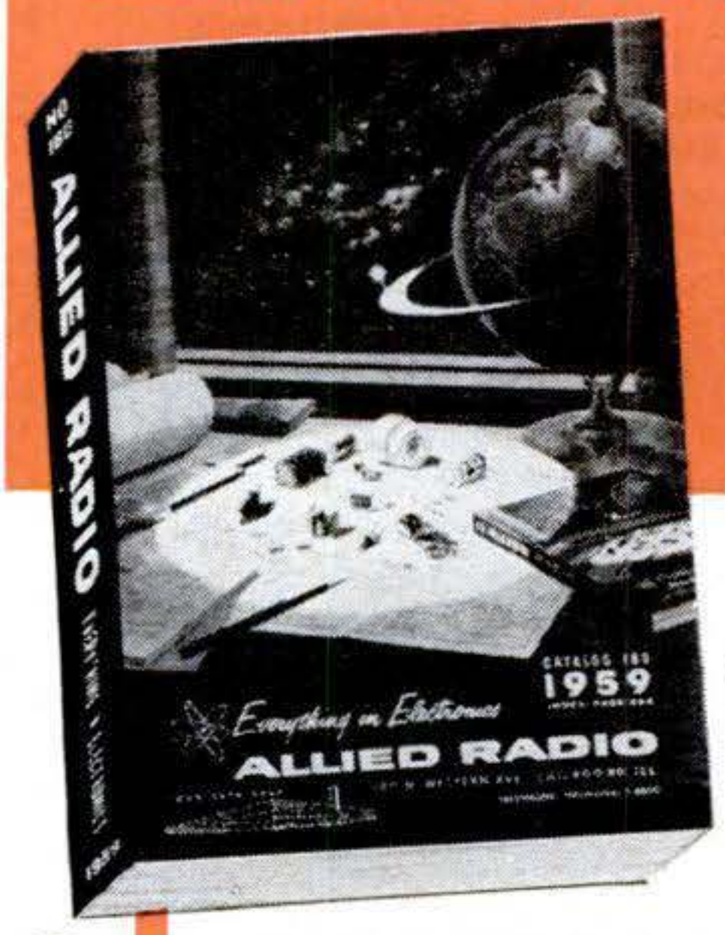

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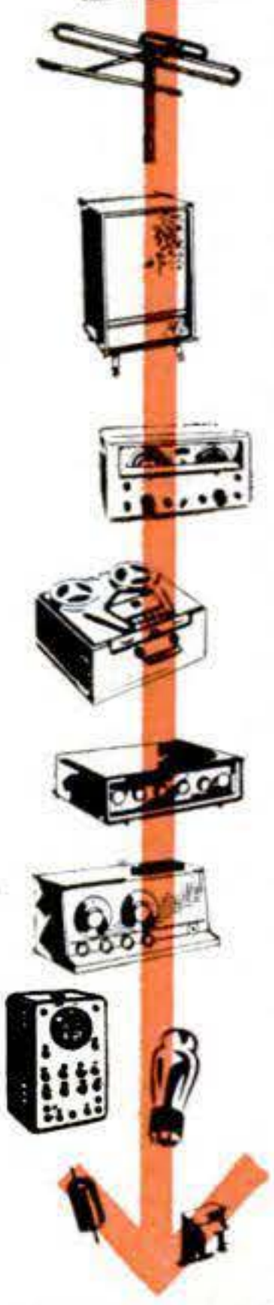

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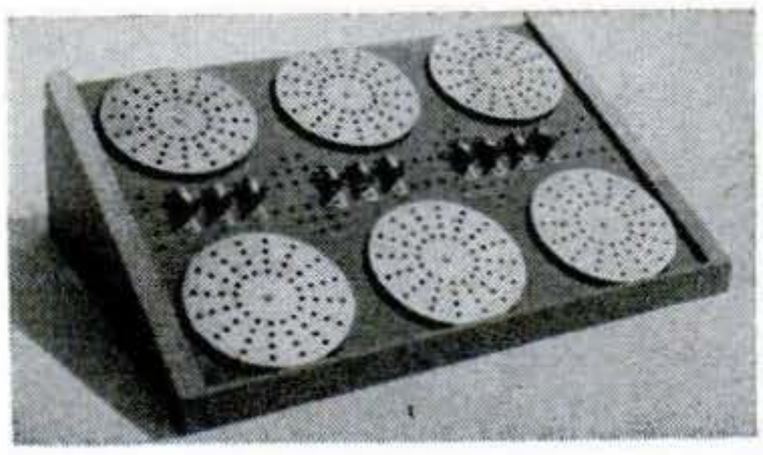

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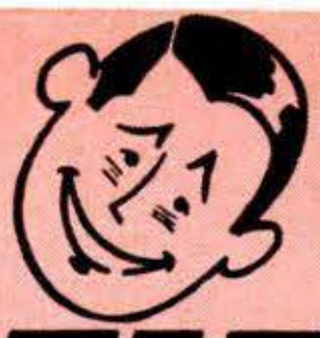

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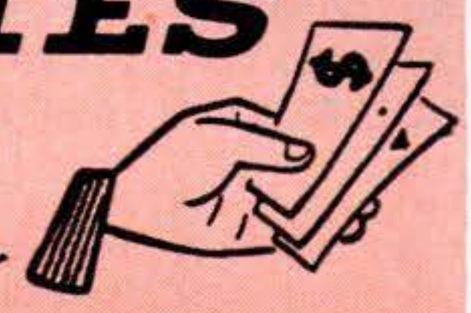

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Advertising, Agencies for Advertisers . . . 53
Agents Wanted . . . 43
Air Conditioning . . . 7A
Antique, Relics & Indian Goods . . . 29
Artists Supplies . . . 76
Astronautics . . . 5A
Authors Service . . . 52
Auto Supplies & Equipment . . . 2
Auto Trailers . . . 3
Automobiles & Midget Cars . . . 1
Aviation . . . 5

Batteries, Generators, Etc. . . . 6
Boats, Outboard Motors . . . 11
Body-Building Courses, Jiu Jitsu, Etc. . . 12
Books & Magazines . . . 23
Business Opportunities . . . 37
Business Service, Information, Name Lists . . . 50
Buy It Wholesale . . . 38A

Cameras, Photo Supplies . . . 34
Camping Equipment & Tents . . . 16
Cartooning, Sign Painting, Chalk Talks . . 54
Coins & Currency . . . 26
Color Photo Finishing . . . 32A
Contests . . . 46

Detectives . . . 47
Do-It-Yourself . . . 66
Dogs, Birds, Hamsters & Pets . . . 17

Educational & Instruction . . . 45
Electrical Supplies & Equipment . . . 7
Enamels, Paints & Varnishes . . . 64A
Engines, Motors, Etc. . . . 10

Farm Machinery . . . 10A
Farms, Other Real Estate . . . 19
Field Glasses, Telescopes . . . 14
For Inventors . . . 60
For Sale Miscellaneous . . . 71
For the Home . . . 69
Formulas, Plans, Etc. . . . 39
Frog Raising . . . 18A

Geiger Counters, Treasure Finders . . . 77

Help Wanted . . . 42
High-grade Salesmen . . . 44
Hobbies, Collections . . . 31
Home Craftsman . . . 65
Hypnotism . . . 24

Inventions Wanted . . . 61

Jokes, Games, Novelties, Etc. . . . 24A

Language Outfits . . . 48
Live Bait . . . 18

Machinery, Tool Supplies, Etc. . . . 9
Magic Tricks, Puzzles, Etc. . . . 25
Manufacturing . . . 63
Minerals & Precious Stones . . . 30
Miniatures . . . 31A
Miscellaneous . . . 79
Models, Model Supplies . . . 64
Moneymaking Opportunities . . . 38
Motion Pictures, Slides, Sound Equip. . . 33
Motorcycles, Bicycles & Supplies . . . 4
Music, Song Writers & Records . . . 35

Of Interest To Women . . . 70
Old Gold, Jewelry, Watches . . . 67
Old Stamps Wanted . . . 27

Patent Attorneys . . . 59
Patents For Sale . . . 62
Personal . . . 80
Photo Finishing, Photocopies, Etc. . . . 32
Plastics . . . 40
Plays, Stories, Etc. . . . 49
Poultry & Supplies . . . 21
Printing, Multigraphing, Etc. . . . 57
Printing Outfits, Supplies . . . 58
Profitable Occupations . . . 22

Radio, TV, Supplies & Equipment . . . 36
Razor Blades, Shavers . . . 74
Rubber Stamps & Office Supplies . . . 56

Science & Chemistry . . . 41
Special Services . . . 51
Sporting Goods, Guns, Fishing Tackle, Etc. . . . 15
Stamp Collecting . . . 28
Swap . . . 79B

Tattooing Supplies . . . 75
Tobacco & Pipes . . . 68
Trees, Shrubs, Roots & Herbs . . . 20
Trigonometers . . . 9A
Typewriters & Office Machines . . . 55

Wanted to Buy . . . 72
Watch Repairing . . . 78
Wearing Apparel . . . 73
Welding, Soldering . . . 8
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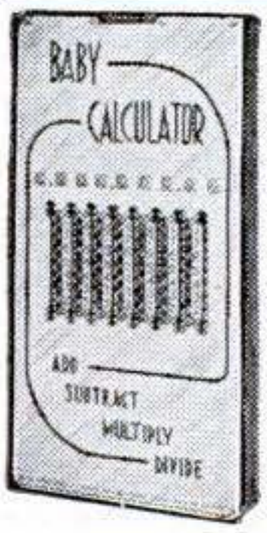

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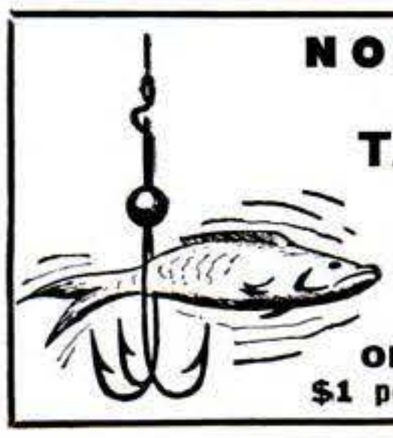

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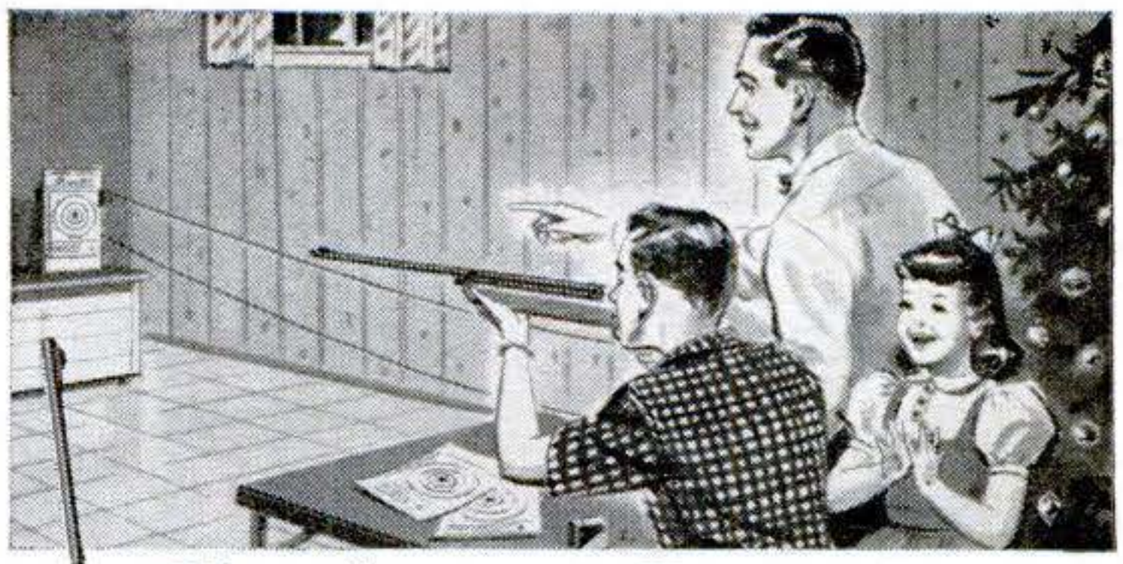

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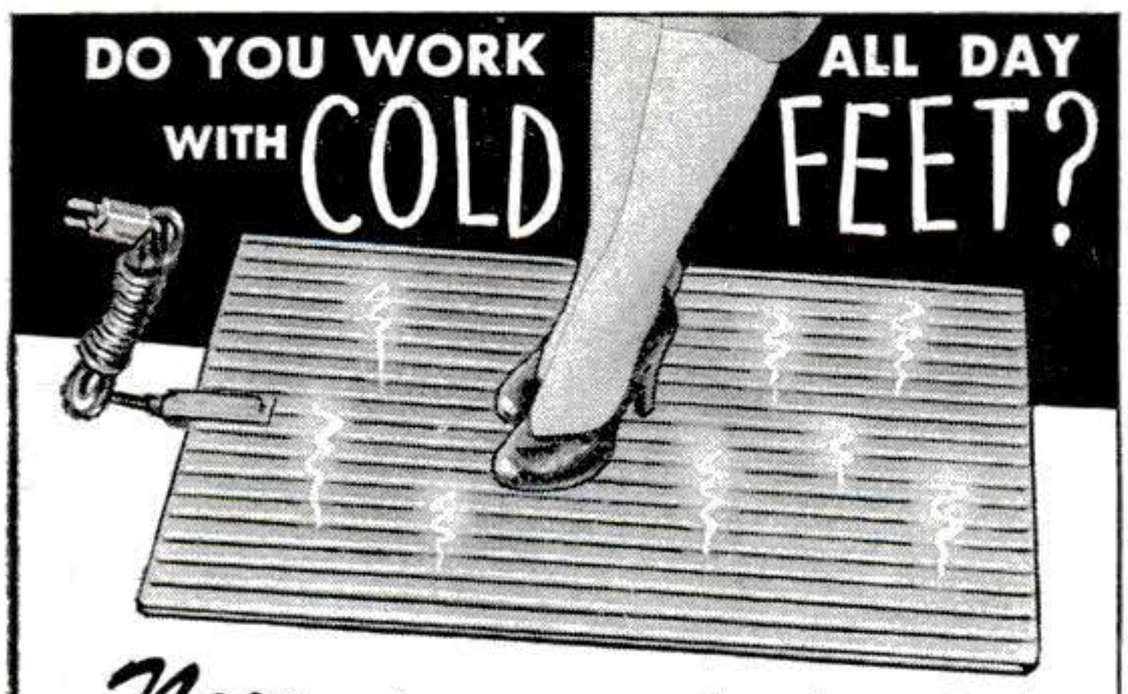

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(signed) Ralph H. Flynn, Publisher

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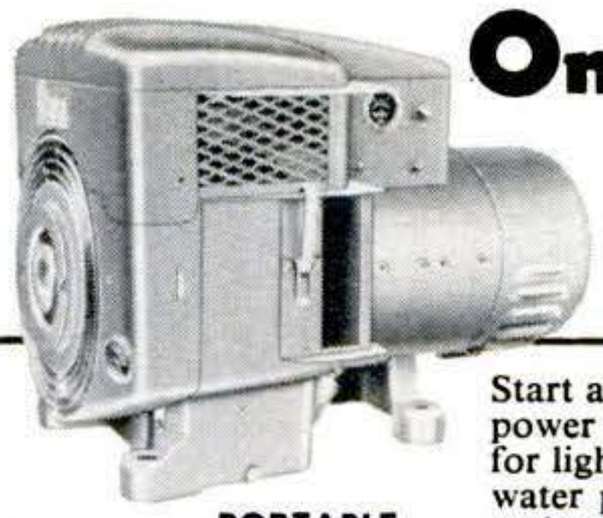

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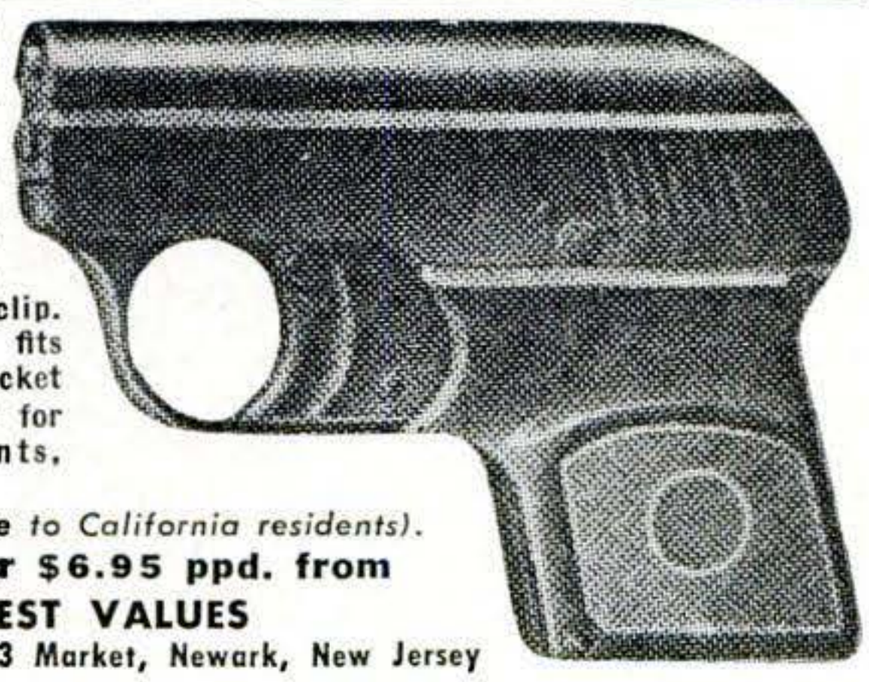

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How Studebaker's New Lark Stacks Up Against Rambler

THE TWO U. S. SMALL CARS: Newcomer is the short-hooded Lark (foreground), 16 inches shorter than the smallish Rambler and more than three inches narrower, but big enough for six persons.

By Devon Francis

OUT of the Studebaker factory in South Bend, Ind., there rolled last month for public display a fresh idea in small cars. Strictly home-grown, stamped Made in America, this vehicle was the Lark, the newest addition to the array of smaller cars, foreign and domestic, now available in the U. S.

In looks, the Lark is simple and pleasing. It's pert. By Detroit's standards, it's truly small. It measures only 175 inches between its interchangeable front and rear bumpers. That's more than three inches shorter than the Rambler American, heretofore the littlest of the mass-produced domestic cars.

Yet—and this is the fresh idea—the Lark seats six persons. It seeks to answer the criticism directed at the many small cars—that though cute and economical, they're skimpy on interior room. The Lark isn't.

And the base retail price at the factory: $1,925.

Studebaker's small car differs in other respects from most small cars. While its standard model is plain to the point of severity, it comes fancied-up, too. There's chrome. There's color. There's enough luxury in the interiors to take the curl

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Up to now America's only small car, Rambler is paired for '59 with an equally fleet, economical Lark

out of the lip of a carping Mrs. on the showroom floor. In ornamentation, the Lark need make no apologetic curtsy to Detroit's gaudy dreamboats.

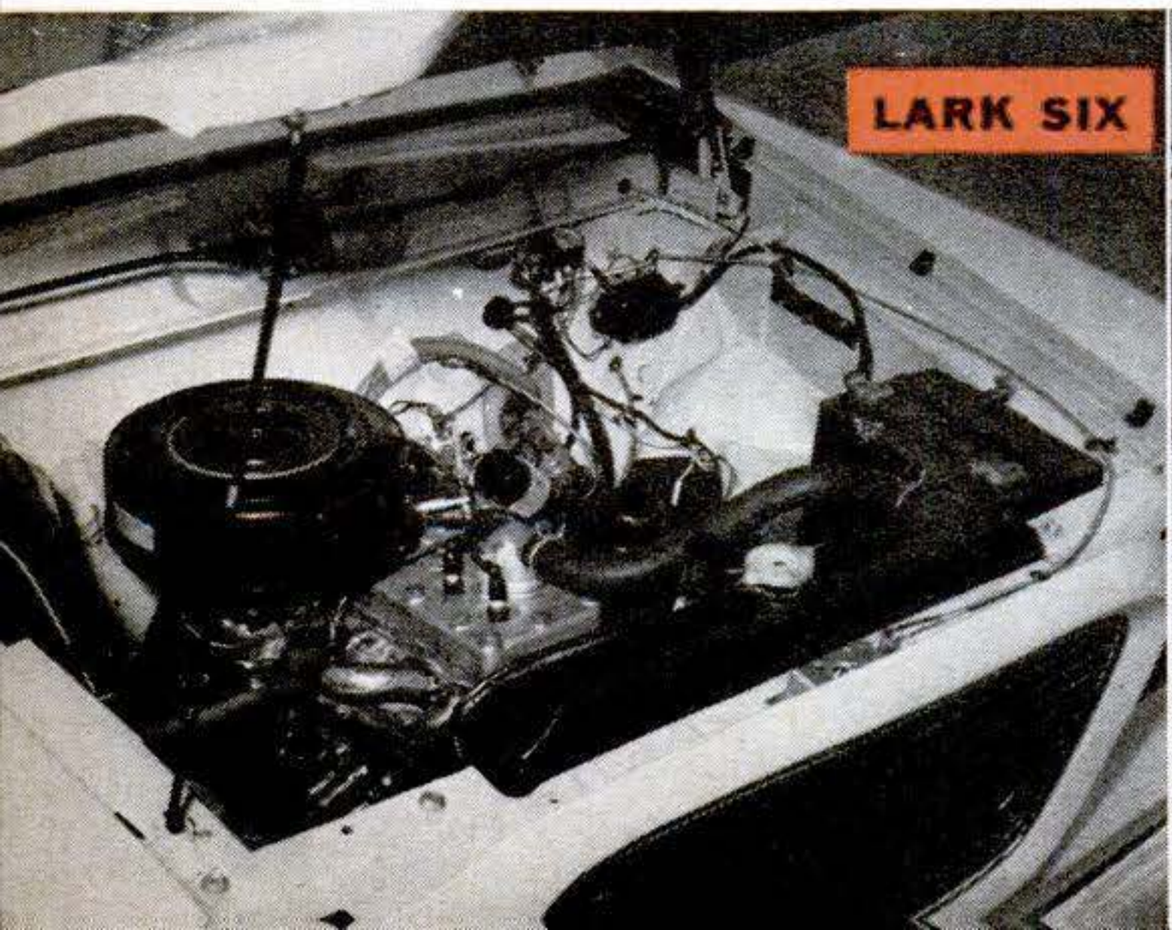
The most prominent feature of the exterior styling is the grille, borrowed unblushingly from Studebaker Hawks. By sheer coincidence, the grille also makes the Lark look like a vest-pocket edition of the Chrysler 300. The rear fenders bear a faint suggestion of the 1958 Chevrolet's. Like the Rambler American, the car is only two-eyed.

Optional power a-plenty is in the Lark for those who like to make a commotion when the light turns green. Zero to an indicated 60 miles an hour in less than 10 seconds is a breeze with the V-8, and when the speedometer registers 100 miles an hour, the needle is still going up.

This implies the presence of other options. They're there, from power brakes and an automatic drive right up through air conditioning. The Lark, in fact, matches more closely—by reason of its weight, price, extra-cost appointments, power and performance—American Motors' bigger Rambler than the roly-poly, matter-of-fact Rambler American.

Last September, I drove the Lark at Studebaker's proving ground. At Burlington, Wis., I also drove the four-eyed Ram-

FLATHEAD SIX is snugged into a smaller compartment than the Rambler's overhead-valve six and produces 37 less horsepower. Studebaker is fueled by a single-barrel carburetor.



bler. I ran gas-economy and acceleration tests on both, in their six-cylinder and V-8 versions. Here's how they stack up.

First, the price. As against the Lark's basic windshield placard of $1,925 (for the cheapest two-door), the cheapest Rambler (a four-door) costs $2,098.

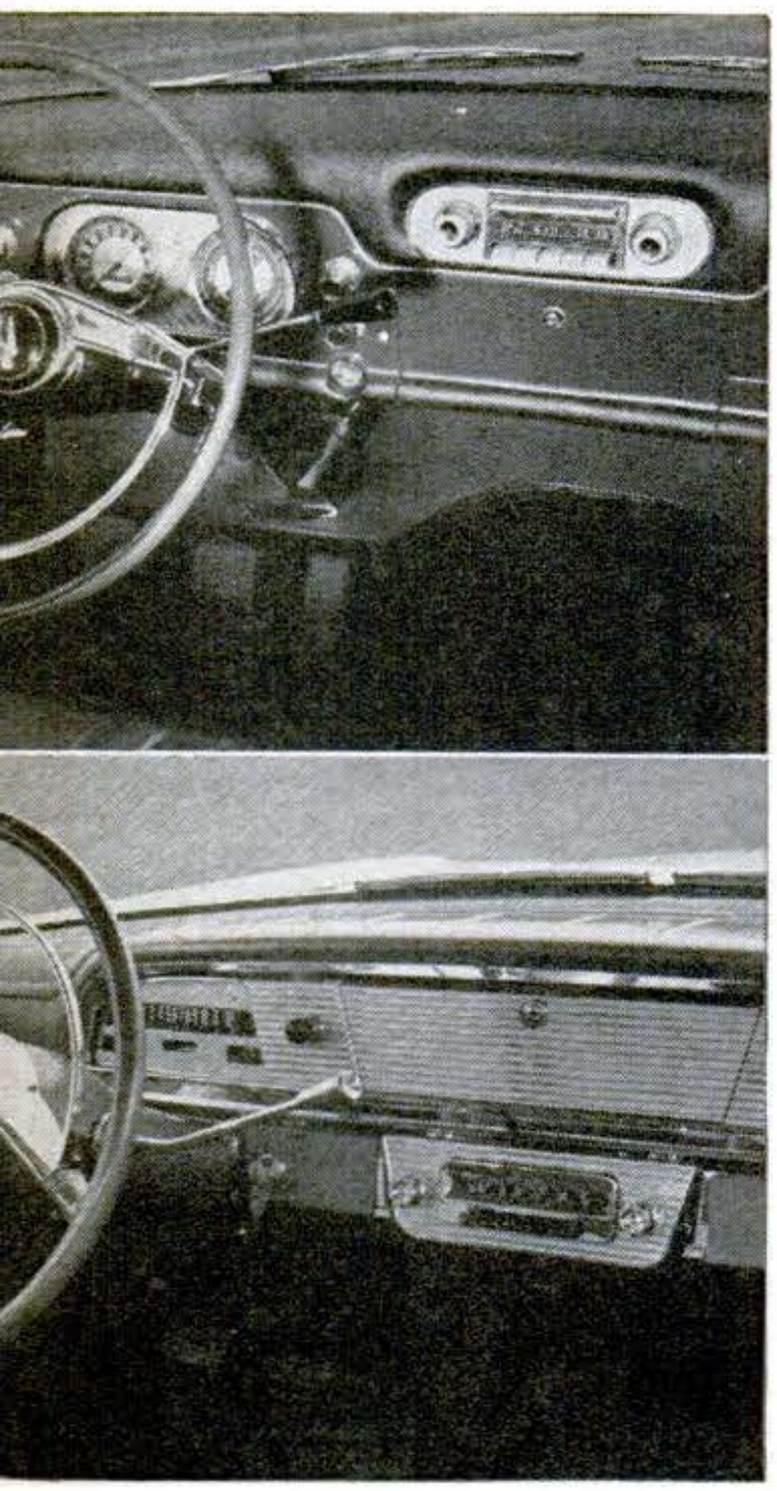
The Lark is, of course, a small car stem to stern. Sixteen inches shorter than the Rambler, it doesn't have the Rambler's big-car appearance—the stylists have chopped off both ends. The Lark looks more like something from Europe.

Yet the hip and leg space afforded passengers in the Lark and the Rambler, as roomy as all outdoors by contrast with most imports, are so alike that they could have been copied from the same blueprint.

Despite their difference in length, the two cars have almost identical wheelbases. At 108.5 inches, the Lark's is a half-inch the longer. Almost exactly 300 pounds separate the two cars in weight in either of their two power versions—with a six or a V-8. The Lark, lighter, has a curb weight—ready to roll, tank and crankcase full but without passengers—of 2,745 pounds with its regular, smaller engine in the prow, and 3,107 with its V-8.

Two of the engines differ. The Lark's six-in-line is a flathead (practically an epithet nowadays); the Rambler's is an

LARK'S V-8 also produces less power than Rambler's but shows better fuel economy. Even with all the options, such as power steering, you can see all eight plugs in the Lark power plant.



LARK'S PANEL (top) is more functional, less decorative than Rambler's. Driver visibility in both cars is excellent. He can see road 14.5 feet ahead of Lark, 15.2 before Rambler.

How they compare: FUEL ECONOMY

	30 M.P.H.	40 M.P.H.	50 M.P.H.	60 M.P.H.
LARK 6 (3.73:1 axle; speedometer 4 m.p.h. fast at 60 m.p.h.)				
M.P.G., overdrive locked out	26.3	22.9	21.8	20.7
With overdrive	33.9	32.8	30.8	25.7
LARK V-8 (3.54:1 axle; speedometer 5 m.p.h. fast at 60 m.p.h.)				
M.P.G., overdrive locked out	24	22.5	20	17.5
With overdrive	27.5	24.5	22.5	20.5
RAMBLER 6 (4.1:1 axle; speedometer 6 m.p.h. fast at 60 m.p.h.)				
M.P.G., overdrive locked out	25	23.1	22	20
With overdrive	30.8	27.9	24.4	21.2
RAMBLER V-8 (4.1:1 axle; speedometer 3 m.p.h. fast at 60 m.p.h.)				
M.P.G., overdrive locked out	22.1	22	19	16.2
With overdrive	24.2	22.3	20.6	18
RAMBLER AMERICAN (3.78:1 axle; speedometer 3 m.p.h. fast at 60 m.p.h.)				
M.P.G., overdrive locked out	33.2	28.3	24.9	21.1
With overdrive	36.5	32.4	27.2	23.7

overhead-valve job. Both engines are under-square—their strokes measure more than their bores—but the Rambler's ponies up 127 horsepower, the Lark's 90.

By the same token, the Lark's six produces less power per cubic inch of displacement and totes more pounds per horsepower.

The Lark and Rambler V-8s—smallest in the U. S. auto industry—have similarities and disparities. Like the in-lines, they are under-square. Their cubages are almost identical. They produce 180 and 215 horsepower, respectively. But again, each horsepower in the Lark has to take care of more car-pounds.

The front entrance room of both cars is nothing short of superb in this day of

How they compare: SPECIFICATIONS

The information here applies, for the sedans, to the standard, lowest-priced four-door (except for the Rambler American, which is a two-door), fitted with the lowest-horsepower engine. For the station wagons, the data is substantially the same, with differences noted. All measurements are in inches except where otherwise specified.

		WHEELBASE	OVERALL LENGTH	WIDTH	HEIGHT	CURB WEIGHT (pounds)	OVERHANG Front	OVERHANG Rear	HIP ROOM Front	HIP ROOM Rear	LEG ROOM Front	LEG ROOM Rear
LARK	Sedan	108.5	175	69	57.5	2,745	27	40.1	59.5	59	44	41
	Station Wagon	113	184.5		58.7	2,850		45.1	59.5			
RAMBLER	Sedan	108	191.1	72.2	58	3,055	32	51.2	59.8	60.1	43	40
	Station Wagon		193.6		58.6	3,177		53.6				
RAMBLER AMERICAN	Sedan	100	178.2	73	57.3	2,584	31.4	46.9	58	45.2	44	37.5
	Station Wagon				58.2	2,662						

NOTES: [a] OHV V-8, 259.2 cu. in., 180 hp. (195 hp. with power pack) is optional; [b] 3.73 with overdrive, 3.54 with automatic transmission; [c] 172.4 with V-8 engine;

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How they compare: LARK vs. IMPORTS

(Prices quoted on imports are for a standard sedan without options at port of entry; only U. S. excise tax and import duty are included. Freight to point of sale, state and local taxes, and dealer preparation-handling charge, if any, must be added.)

	LENGTH (in.)	WEIGHT (lb.)	HP.	PRICE
LARK	175	2,745	90	$1,925
AUSTIN A-35	136	1,480	34	1,557
BORGWARD	175	2,200	65	2,495
CITROEN DS-19	189	2,470	75	3,295
FIAT 1200	154.2	2,050	55	2,253
FORD ANGLIA	150	1,700	36	1,442
FORD CONSUL	172	2,500	60	2,012
FORD ZEPHYR	178	2,690	90	2,193
HILLMAN	163	2,200	51	1,699
MERCEDES-BENZ 180	175	2,555	74	3,240
METROPOLITAN	149.5	1,875	55	1,626
OPEL	175	1,908	51	1,957
PEUGEOT	176	2,360	66	2,175
RENAULT DAUPHINE	155	1,397	32	1,645
SAAB 93B	158	1,735	38	1,895
SIMCA VEDETTE	178	2,595	80	1,999
TAUNUS	172	2,260	67	2,108
VAUXHALL	168	2,218	55	1,957
VOLKSWAGEN	160	1,565	36	1,545
VOLVO	177	2,120	85	2.238

LARK'S TRUNK (top) contains 18.6 cubic feet, but intruding tire consumes part of it. Rambler's 13.5 cubic feet is all usable. Lark produces sedans, hardtops and station wagons.

stoop-and-squat. It's far better, for instance, than those of the Chevrolet, Ford or Plymouth, partly because the doors of the smaller vehicles don't suffer so much from the intrusion of the wraparound windshields. It's partly, too, because the roofs are higher. The Rambler's entrance room, measured from the point on the door nearest the edge of the seat back, is 36 inches, and from sill to roof it's 38.2 inches. The Lark's respective measurements are 36 and 43 inches.

Rear entrance room on both cars could stand improvement.

Driving compartments are comfortable. Foot pedals, unlike those of many of the imports, are big enough to hit blind. You

[Continued on page 228]

	HEAD ROOM Front	HEAD ROOM Rear	DIAMETER OF TURNING CIRCLE (feet)	ROAD CLEARANCE	ENGINE TYPE	PISTON DISPLACEMENT (cubic inches)	BORE AND STROKE	COMPRESSION RATIO (:1)	HORSEPOWER (at r.p.m.)	HORSEPOWER PER CUBIC INCH	CAR WEIGHT PER HP. (pounds)	TORQUE (pounds-feet)	FUEL REQUIRED	GAS-TANK CAPACITY (gallons)	AXLE RATIO (:1)	TIRE SIZE	BRAKE-LINING AREA (square inches)
	36	35	37.5 39	6.7	L-head 6[a]	169.6[a]	3x4	8.3	90@4,000[a]	.53	30.5 31.6	145@2,000	R	18	3.54[b]	5.90x15	147.4[c]
	36	35	37.2	6.7	OHV 6[d]	195.6[d]	3.125x4.25	8.7	127@4,200[d]	.64	24 25	180@1,600	R	20	3.78[e]	6.40x15	150.2
	35.2	34	36	6.7	L-head 6	195.6	3.125x4.25	8	90@3,800	.46	28.7 29.5	150@1,600	R	20	3.31[f]	5.90x15	139.5

[d] 138 hp. with power pack; OHV V-8, 250 cu. in., 215 hp., is optional;
[e] 4.38 with overdrive, 3.31 with automatic transmission; [f] 3.78 with overdrive.

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PS EXCLUSIVE

Man's First Leap Toward Free Flight

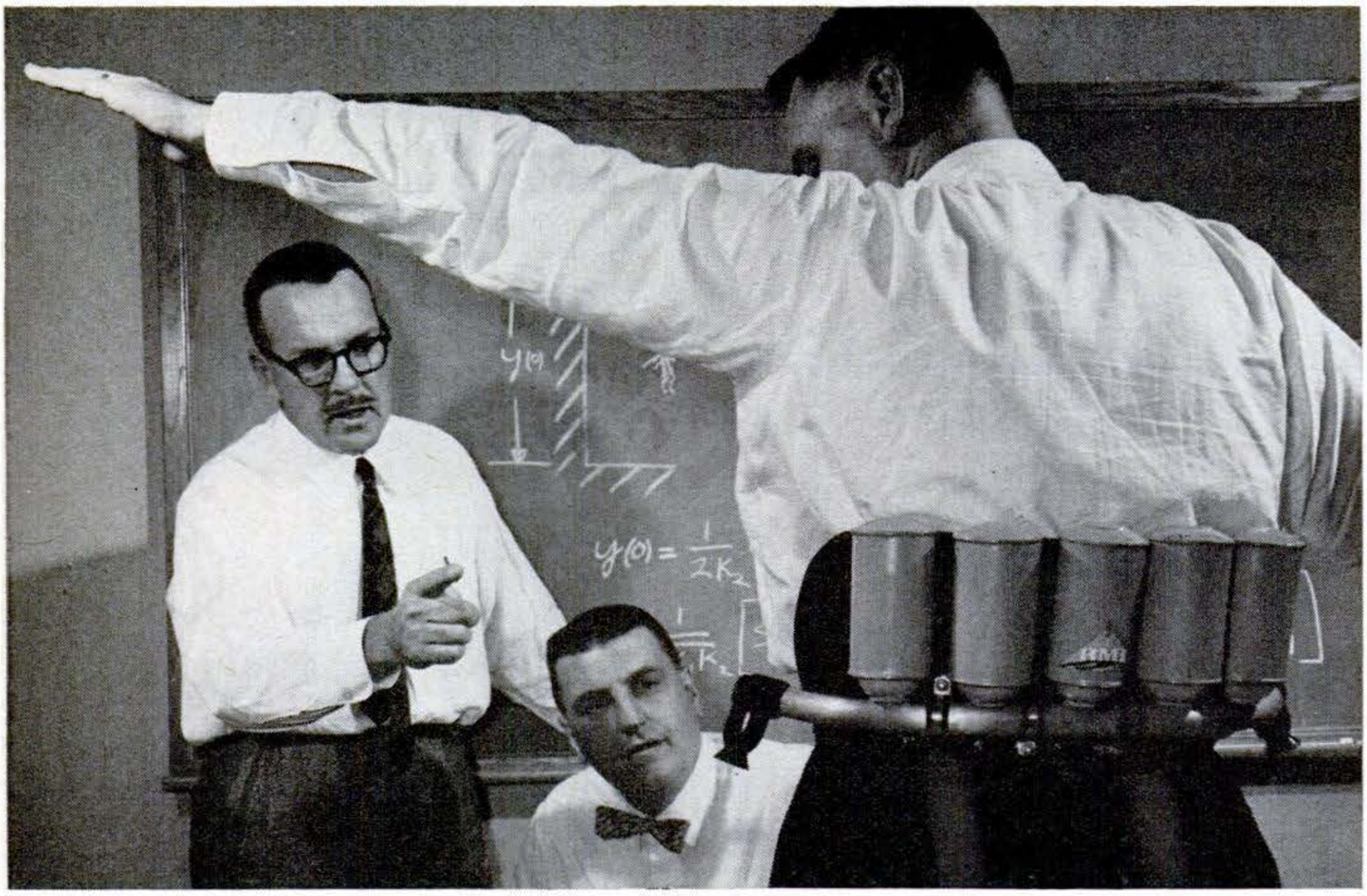
With the one-man jump rocket —already here—we're on the way to a true flying belt

By Eliot Tozer

MAN'S age-old dream of flying like a bird, free of any clumsy machinery, may be nearer than we think. Listen to this:

"We're working right now on a 'flying belt.' It will strap on a man's back. It will rocket him to an altitude of several hundred feet, and shoot him horizontally for several thousand yards. When he wants to land he'll simply reverse thrust and coast gently back to earth."

The speaker, no dreamy theorist, was a hard-headed scientist: Harry W. Burdett Jr., manager of "Project Grasshopper" at Reaction Motors Division of Thiokol Chemical Corporation. He was explaining to me that the flying belt was a logical development of something simpler called a "jump rocket." This is the infantryman's accessory that was disclosed—with very few details—in a brief announcement last summer. The whole story, never before revealed, is exciting,



Alex Bohr and Harry Burdett Jr. examine five-canister, two-nozzle belt worn by Ray Wiech.

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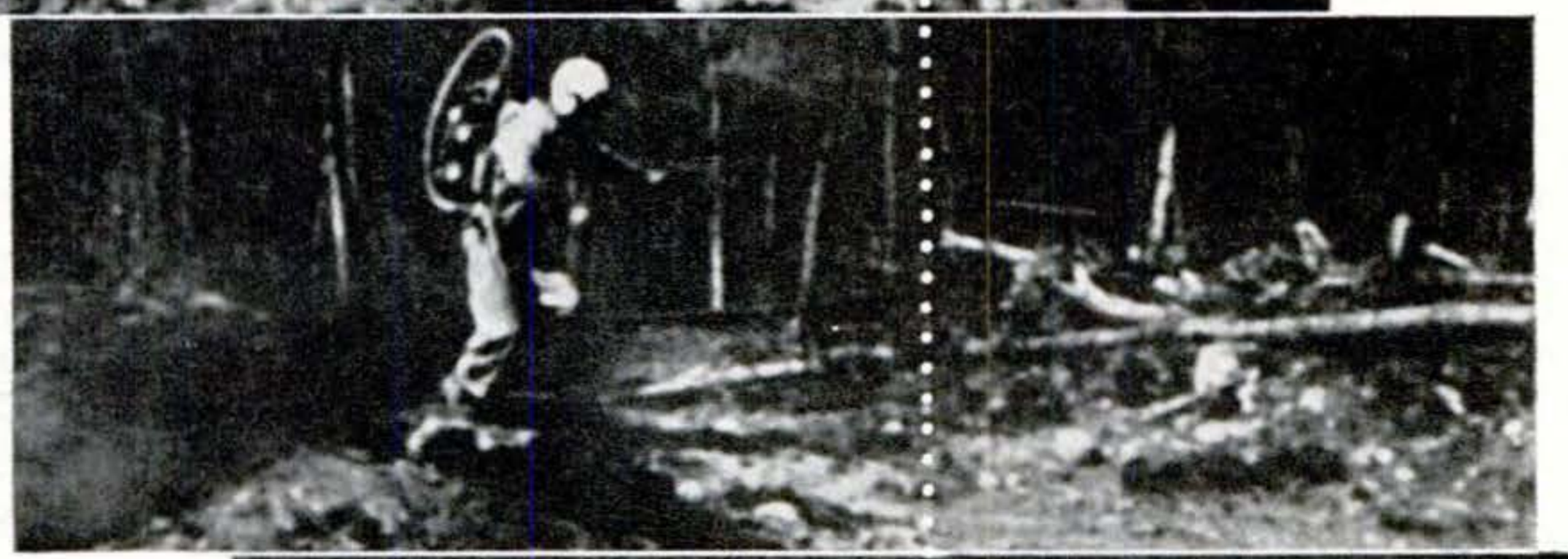
Belt gives a GI seven-league boots



BREAKING THE WORLD'S broad-jump record (26 feet 8¼ inches) is a cinch for this soldier with a crude early version of the one-man jump belt strapped to his back. Improved model will let him leap a sizable river, jump from the ground into a second-story window, or race cross-country at up to 35 miles an hour.

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complicated, and partly cloaked by security. It also has amazing implications about the world we'll be living in soon.

The jump rocket. This exists now. It is under close study by the military. It is a solid-fuel device that can be strapped around a soldier's middle. Performance figures are classified, but observers estimate that with it a soldier can:

- Broad-jump a 50-foot river and land on the other side ready to fight;
- Leap from the ground into a second-story window, firing as he enters; or
- Jump off the roof of a house and, landing on his feet, race off at 35 m.p.h.

The jump rocket, then, is a step toward the flying belt. If it does not give a soldier wings, it does give him seven-league boots.

The story starts one Saturday morning in 1940, at West Point. It was just after a class demonstration of flame throwers, in those days powered by tanks of highly compressed nitrogen gas. While cleaning up, a sergeant inadvertently loosened the valve on a full tank of nitrogen. As it spat and hissed, he asked Lieutenant Charles Parkin: "What would happen if I opened this thing all the way?"

"It would probably go skittering across the field."

"Could I hang on and get a ride?"

Parkin thought it might be possible.

Years later, after the war, Parkin—now a colonel in Engineering Research and Development—recalled the incident at West Point. He decided to try an experiment. He strapped a tank of nitrogen to his back, suddenly released the gas through a nozzle, and at the same instant, jumped upward. Despite the weight of the tank, he found that he could consistently jump higher with the lash-up than without it. He asked several companies to submit proposals for a simple, compact jump belt. Reaction Motors was the first to produce the actual hardware.

Designing the thing was no cinch, engineers at Reaction Motors discovered. "It's hard to mount a high-thrust rocket on an amorphous hunk of flesh," explained Alex Bohr, the project engineer.

"And we didn't know how the fellow would right himself if he lost his balance," added Ray Wiech of the special-projects group. They decided to stick with compressed nitrogen for the first experiments.

The first try-out took place last winter, at a remote test area. "This thing sounded too much like Buck Rogers," Burdett explained, "so we sort of worked off by ourselves." Wiech strapped on model No. 1—a pair of big nitrogen bottles riding uneasily on a back pack, vented through two nozzles on a bar that reached above his head.

Pulling his felt hat down tight, Wiech punched the actuator button. The gas roared downward, pushed him up and held him for an instant, and then let him down like a feather.

"It was a strange sensation," Wiech told me. "I took off as if I was in a fast elevator, swung in the parachute harness for a moment, and then came down like a puff of milkweed."

Burdett and Bohr told him to try it again, this time pushing off at the same instant that he punched the button. In the midst of the roar of expanding gas, the startled Wiech set a new world's high-jump record. Right then Burdett and his colleagues knew for sure that they were onto something important.

But people differ. During early spring they collected the dimensions of the "median man"—the person whose height, weight and center of gravity put him in the middle of the scale that included all men. They shaped a harness with two gas tanks that were tailored just right for this ideal man. They found that Ed Kurczewski, who worked in the company's test department, fitted perfectly.

By late spring they were ready to go for distance. They jacked up the pressure in the bottles, strapped Kurczewski in the new rig, and gave him the sign. As he fingered the button, the two nozzles mounted on a frame above his head spewed gas viciously. Dust and pebbles kicked up as the thrust forced the upper half of his body forward—and almost augered him headfirst into the ground.

"Ed was tense," Burdett explains. "But he caught on fast. Next time he flailed his arms and came down like a cat."

The center of thrust was obviously too high. They built a new model with only one nozzle, mounted low. On jumps, Ed rode this as easily as if it were a tricycle—but the nozzle was no help when he tried to run. So they switched to a three-nozzle, over-the-head configuration. The theory was that the three shafts of

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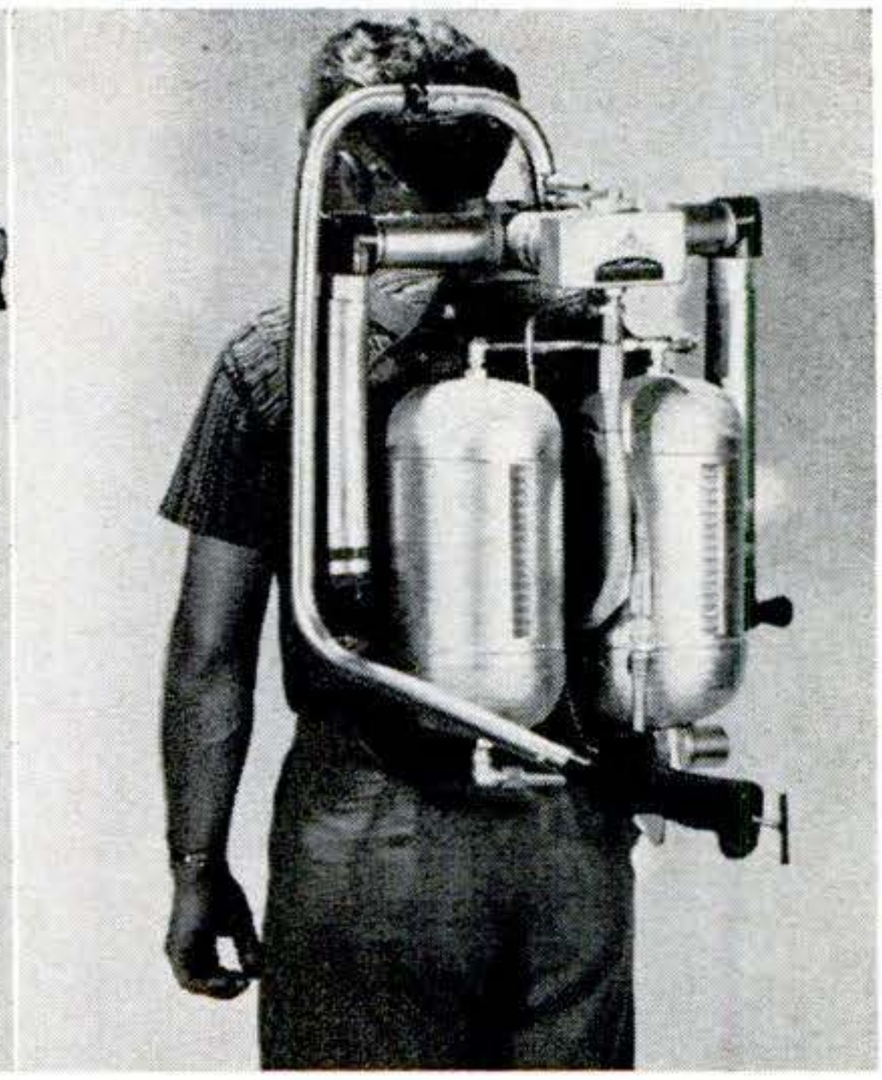
First Look: The Hush-Hush Flying Belt



THESE hitherto unreleased photos show an early model of the secret "Flying Belt." In view at right, jets and control are folded for maximum convenience; in the other they are in flying position. Thrust angle is changed by moving the control forward or back, and amount of thrust or lift is varied by the movement of the hand grip.

The belt would enable the wearer to rise quickly to an altitude of several hundred feet and fly "miles."

How soon will the Flying Belt emerge from the laboratory? Reaction Motors' engineers estimate delivery of a workable one within two years.

high-velocity gas would be like the legs of a tripod.

Kurczewski crouched, hit the button, and sprang. A slightly misaligned nozzle spun him into three-quarters of a turn and he came down hard, arms and legs flailing. They hadn't found it yet.

Further trials showed that the nozzles had to be mounted low, fairly close together, and near the body's center of gravity. The bulky harness was discarded in favor of a belt with two nozzles—one on each hip—aimed outward and downward. It worked fine.

"We had solved the mounting problem," said Burdett, "and we knew that during the leap the average GI could stabilize himself, moving arms and legs."

They decided to make the transition from the relatively tame compressed-gas system—too heavy and low-powered for military use—to a solid-fuel rocket system. Here the potential energy was far greater—pound for pound, 10,000 times more powerful than an automobile engine. And the risk was far greater, too.

(Strangely, there is no apparent danger from the jet flame. When the unit is firing, it is impossible to force one's hand accidentally into the "hard" jet stream.)

Compared to the old method, the new rig was light and compact, scarcely bulkier than a cartridge belt.

It was simple, too. To fire it, the operator would merely push a button. Said Alex Bohr: "Like firing a gun. Each charge is like a large cartridge, and the wearer 'explodes' it by mechanical percussion."

By late spring they were fully ready for advanced compressed-gas testing. Kurczewski strapped on his helmet, pulled down the visor, and crouched. He pressed the button and a shotgun blast of exhaust gases ripped through the woods. Riding two jets, he rose smoothly into the air. Dust and rocks billowed up in clouds behind him, and the hollow roar of the little jets, pulsing with power, washed furiously over the bystanders.

In panic, Ed cut off the thrust and,

[Continued on page 220]

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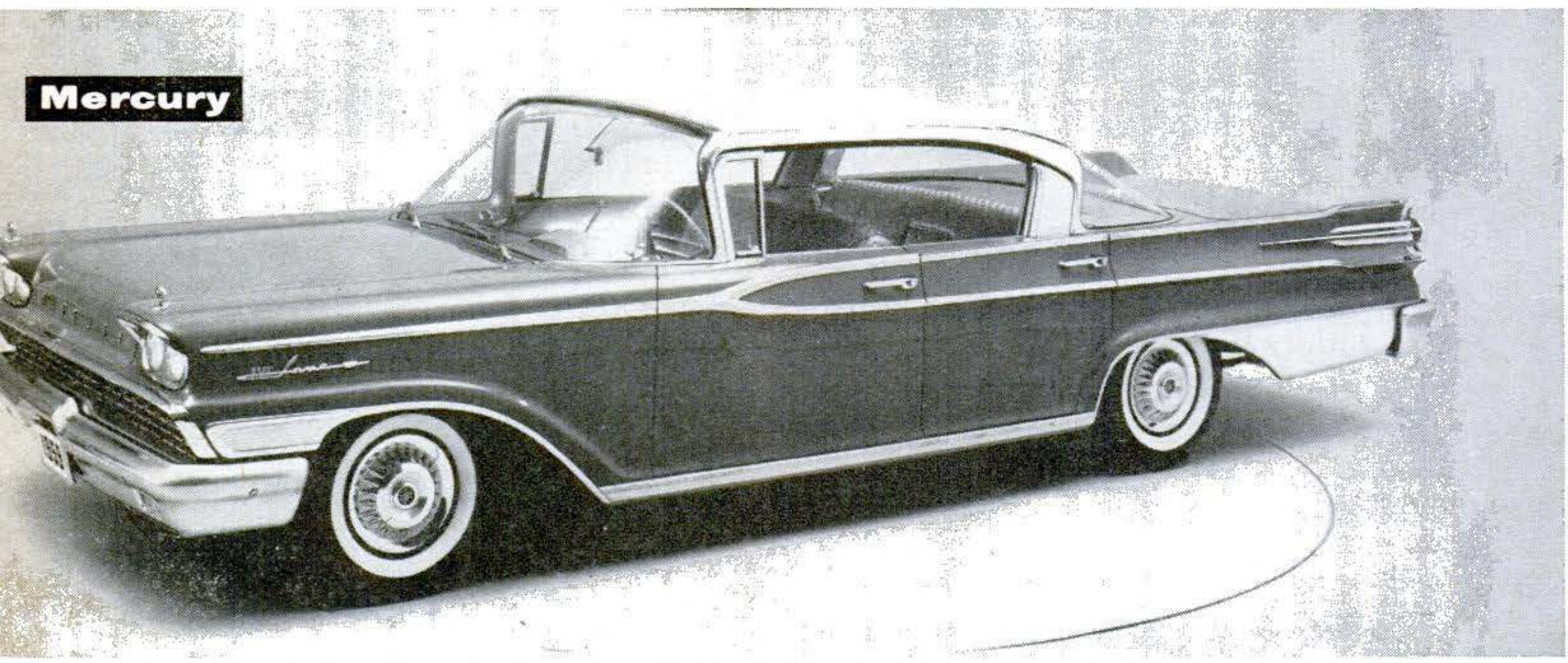
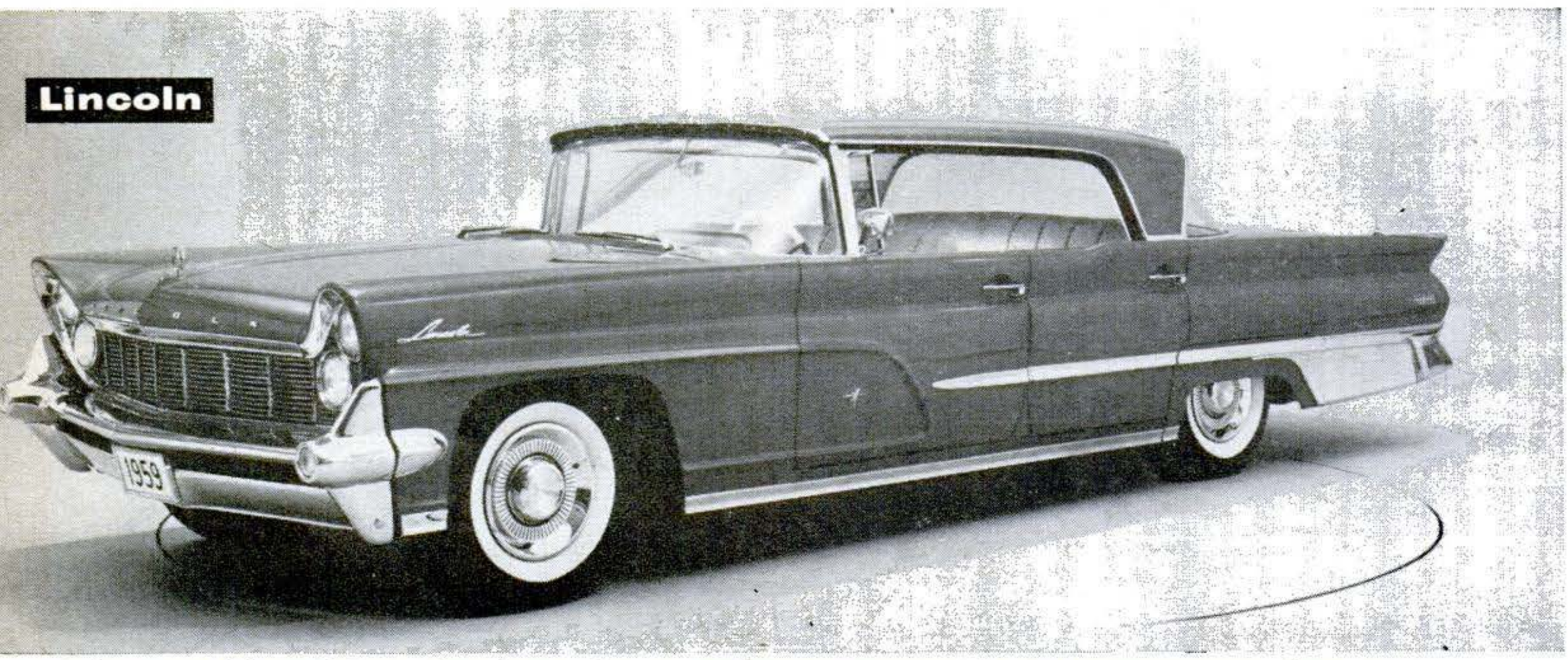
Less dressy, less costly, it comes with one body, one length and—optionally—less horsepower.



New skin over a longer body hides new mechanical magic in controls, engine, transmission.



Disdaining ebb and flow of styling tides, Lincoln is content with minor appearance changes.

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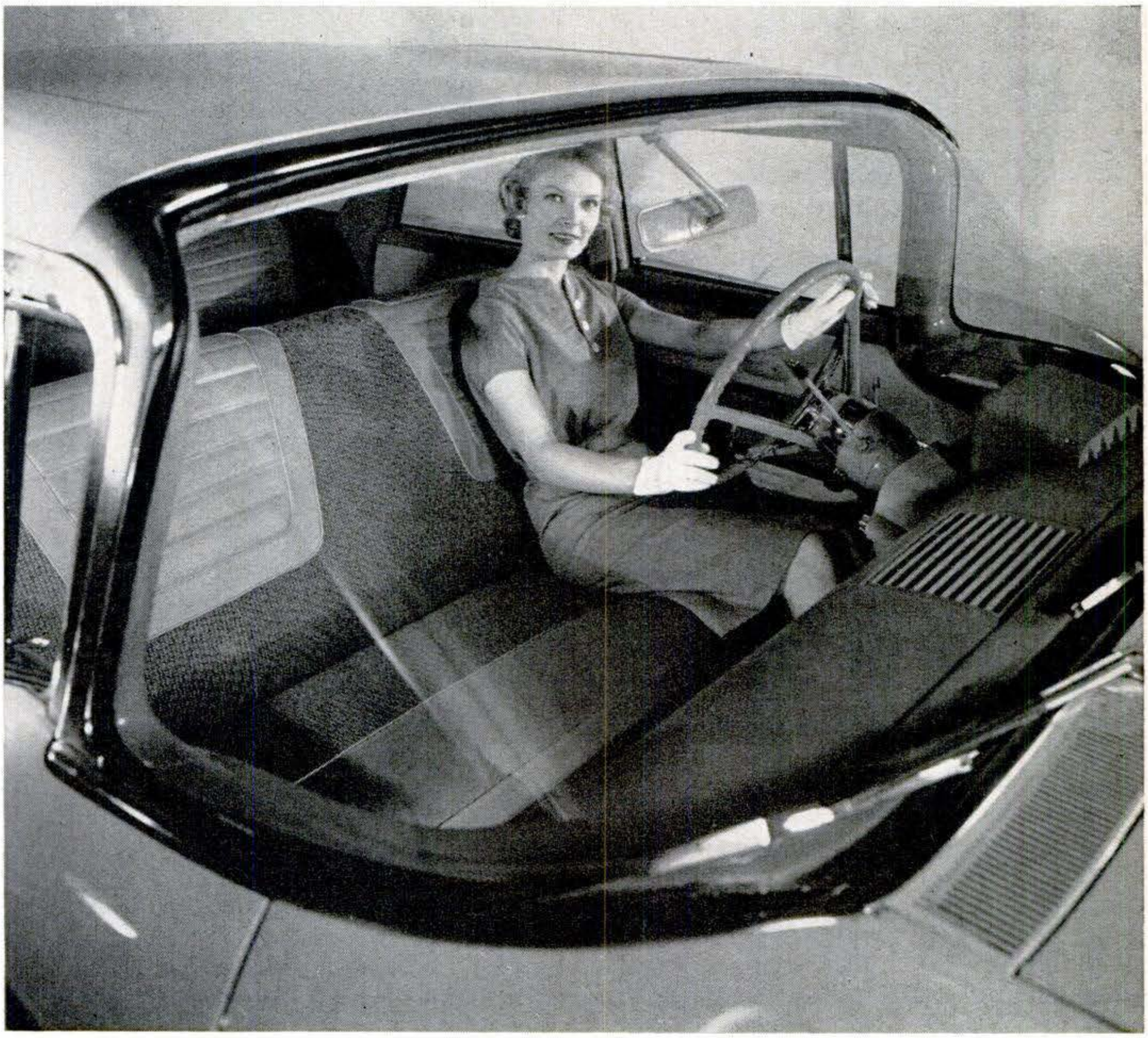
What's New with Edsel Mercury Lincoln

By Devon Francis

THINGS are all straightened out now between the Edsel and the Mercury, and peace reigns once more at the Ford Motor Co. When the 1959 models of these cars were announced last month, along with the Lincoln (which shares essentially the same body with the fancier Continental), the Edsel was just what it was supposed to have been when it was born a year ago to a bugle-call accompaniment.

It's a sensible automobile. It has shed some of its spangles and many of its gimmicks. It has one wheelbase, not two, one overall length, not two, one body, not two. In price it's a cut above the sauciest Ford



Huge windshield and a cockpit seven inches deeper than last year's give Mercury this look.

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and a cut below the nakedest Mercury.

The Mercury, too, is what it's supposed to be—a rather flossy affair that runs in such company as General Motors' Oldsmobile and Chrysler Corporation's De Soto.

Hundreds of changes, big and small, have been made in the Edsel, fewer in the Lincoln and Continental. The Mercury is completely new.

All three cars—or all four, if the Continental is accepted as a separate breed—are readily recognizable. Unlike the 1959 GM cars, Ford Motor's don't belie their ancestry. They have what Detroit calls "product identification." They *look* like Edsels, Mercurys, Lincolns, Continentals and, yes, Fords.

All this bespeaks an orderliness, a tidiness, that wasn't present a year ago. The Edsel and the Mercury were in argument, and here's how it was settled:

Edsel *narrows its field*

In August, 1957, the shrouds were pulled off a new brand of car, the Edsel. Front and rear, it was styled to look different from other cars. It did. It was also too-tinseled, too-gewgawed. The Edsel was like an overdressed girl at a staid Wednesday-afternoon garden party. Its respectability was under suspicion.

This year the Edsel people collected the shards of their experiment and rearranged their pattern. The result is pleasant. The styling is simpler. All sorts of gadgets have been discarded—among them the pushbutton automatic-transmission controls on the steering-wheel hub, a remote-control trunk lock, a three-stage engine warmup, and air springs (probably the auto industry's biggest collective goof in 1958).

The Edsel retains its product-identification marks: that vertical, elliptical "impact ring" on the front and the gull-wing rear fenders. But it's all in better taste. Rear lights have been removed from the wings and clustered below the deck lid. Headlights are dropped inches below the fender line and centered in the grille.

The car is less pretentious. It's designed to offer more transportation and less carnival showiness. Last year the Edsel had something for everybody. In price it overlapped the costliest Chevrolets, Fords and Plymouths. It blanketed the Pontiac and Dodge and reached up to cover most of the Mercury, Buick, Oldsmobile and De Soto lines.

Now it has found its place. In price it *averages* considerably lower than last year. It's not above offering the buyer a six-cylinder engine in addition to last year's big-muscled V-8s. This last-minute engine decision was no problem—the engine was borrowed directly from the Ford Division. Horsepower options start at 145 and range up to 303.

Last year the Edsel came in four series that grew gaudier in crescendo—the Ranger, Pacer, Corsair and Citation. The Pacer and Citation lines now have been dropped. The Ranger is somewhat upgraded, and the Corsair has lost some of that piratish, walk-the-plank abandon.

Last year the Edsel had two wheelbases, 118 and 124 inches, and overall lengths ran from 213 to 219 inches. This year there is one wheelbase, 120 inches, and one length, 211 inches. The room afforded the driver and his passengers is, nonetheless, about the same.

The car is a few pounds heavier than the 1958 Ranger and Pacer but 400 pounds lighter than the '58 Corsair and Citation. Station wagons are, of course, included in the line.

New optional machinery includes the simpler, lighter, two-speed automatic drive available on Ford cars [PS, Nov.]. A more sophisticated one with two driving ranges is retained.

Numerous little improvements include enlarged mufflers, mated more precisely with engine-exhaust flow. Those putt-putt-putt resonators have been dropped. Dual exhausts are now an option except on the six-cylinder engine, where—of course—they're not available.

At the home of the Edsel in Dearborn, Mich., a gray, time-mellowed building that was dear to the heart of old Henry Ford, the men who guide the destinies of the car are far from discouraged because it didn't prove to be as popular in its first year as they thought it would be.

For three weeks last summer every tenth family visiting the Ford Rotunda in Dearborn, a sort of display case for company products, was invited into an inner room for a peek at the 1959 Edsel. The visitors didn't know that the room was forested with microphones recording

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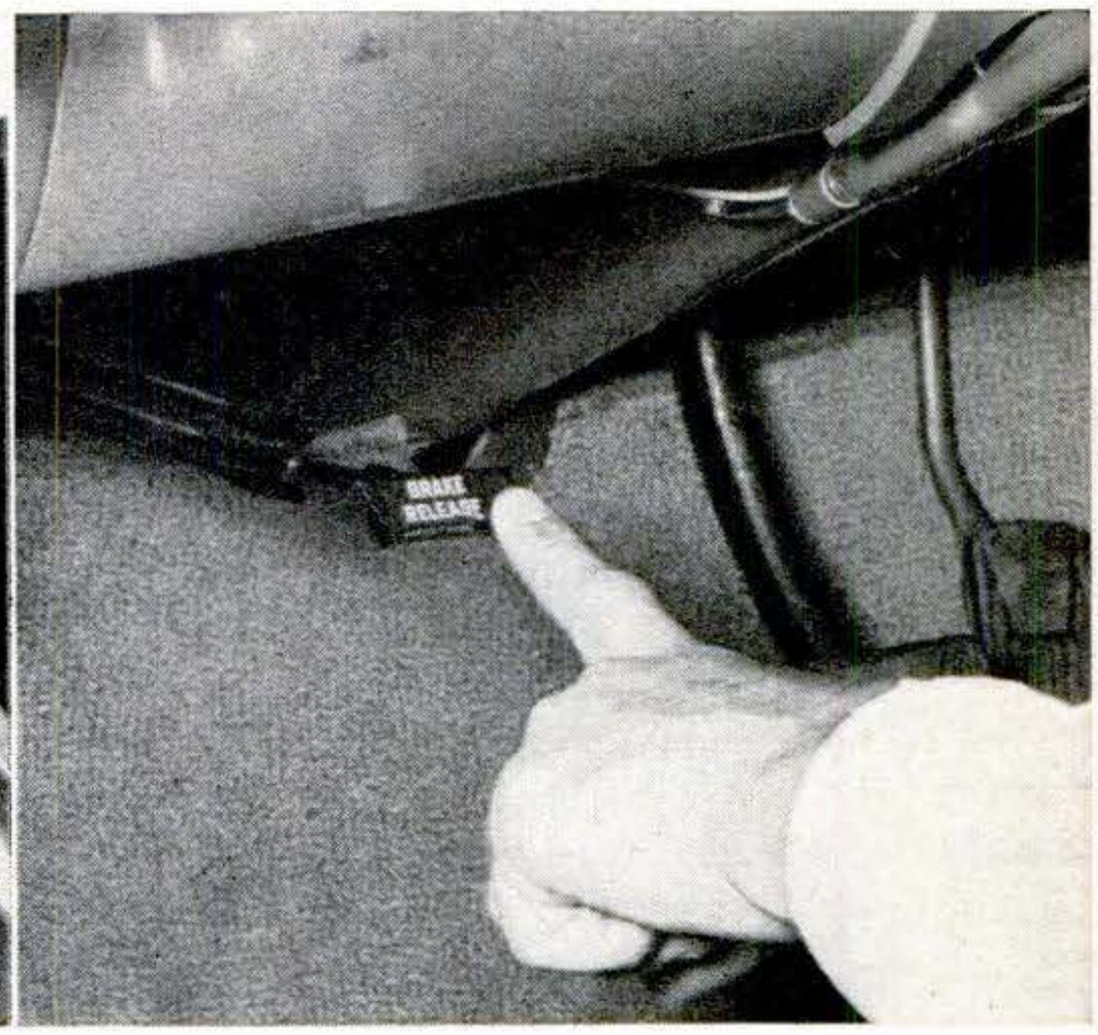
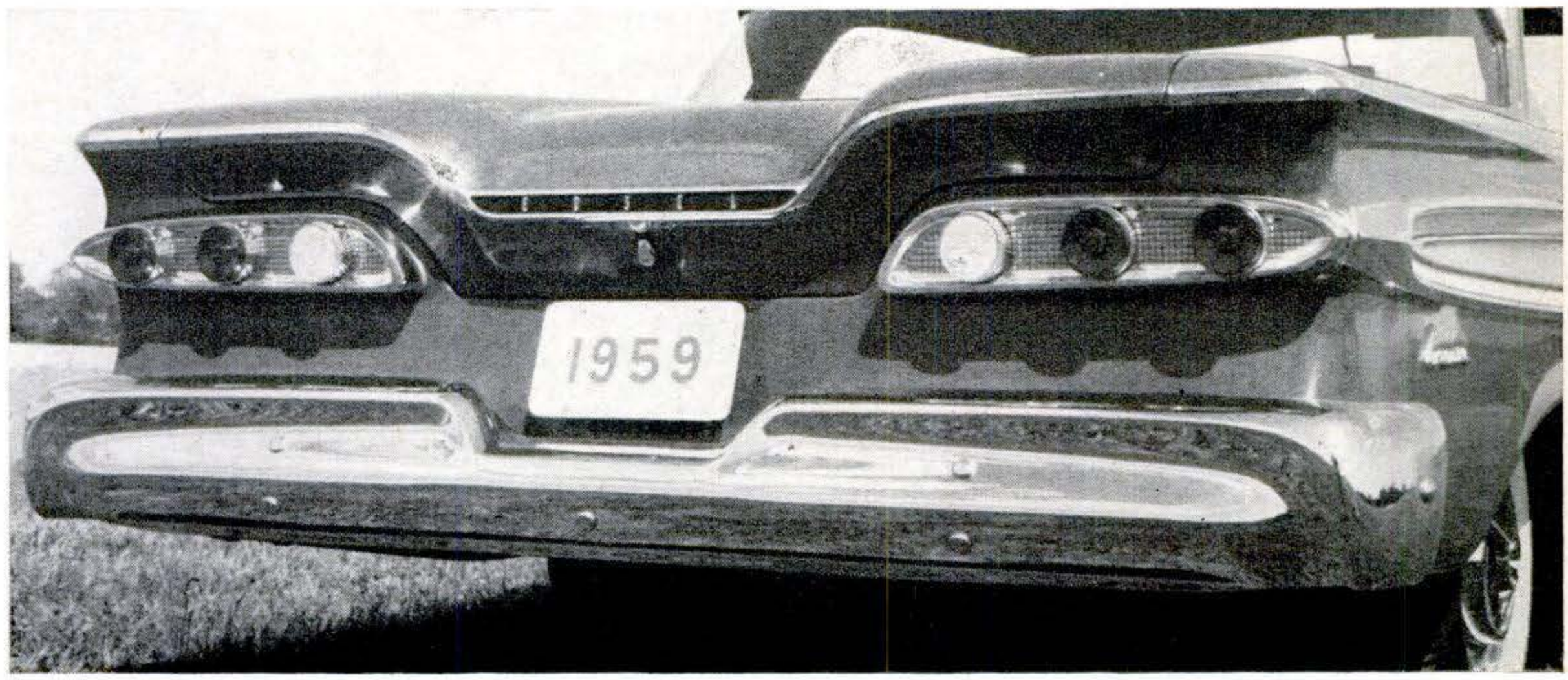
New Edsel (right) retains vertical center grille that caused so much comment in '58 (left).

TURN-AND-PULL-OUT TAIL LAMPS have fittings like photo flashbulbs. Inboard lamps on Edsel are turn signals, next is running light and third is a combination running- and stop-light.



EDSEL PARKING BRAKE is released by pushing down on metal tab. Rear springs, softened, are lengthened three inches to 58 inches and widened a half-inch to 2.5. Mufflers are bigger.



Lip of trunk has wide cutout at center, reducing height from ground for easier loading.

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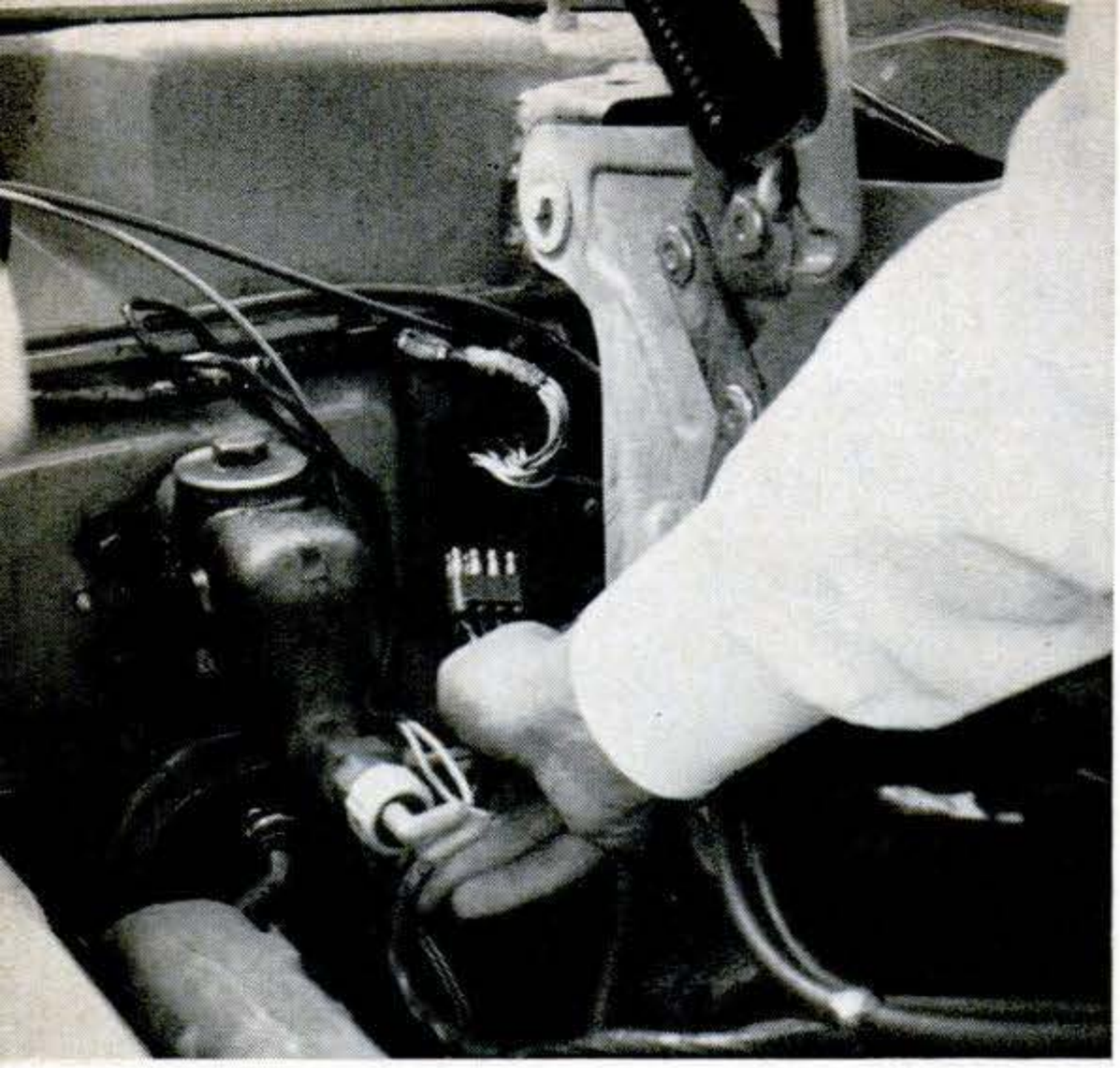
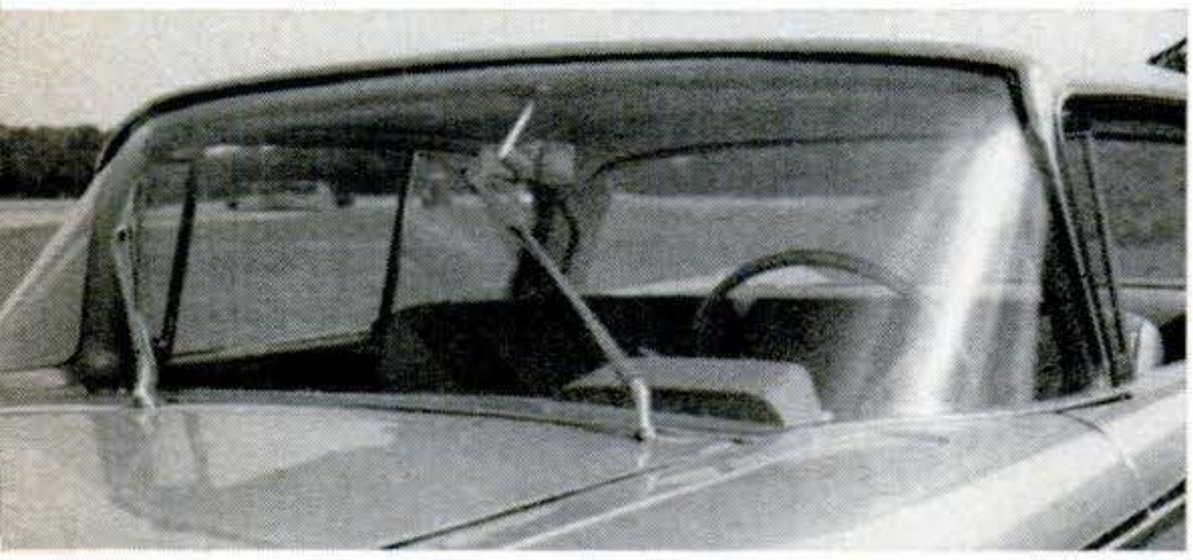


MERCURY AND EDSEL SHARE an electrical quick-disconnect feature—a plug that pulls out of a jack on the bulkhead. It's no longer necessary for mechanics to "skin" wires through the wall.



PARALLEL WIPERS overlap at center of windshield, which is 29 inches high and 93 inches around at base. For a better road view, the hood has been shortened by 1.5 inches to 55.5.

their comments. Practically all of them estimated the price at several hundred dollars more than it turned out to be.

The Edsel people feel pretty good about that.

Mercury *gets bigger and flossier*

The Mercury for 1959 firmly establishes itself as Ford Motor's flashy centerpiece in the middle-price field. Last year that wasn't so. The brash, upstart Edsel, ranging flirtatiously all over the price dial, created confusion compounded. Now the Merc gives the Edsel the back of its hand.

It's snootier than the Edsel—and snootier than it was, itself, in 1958. It's bigger—and bigger than in '58. It has a lot more options than the Edsel—and more than it had, itself, in '58. It has all sorts of new mechanical things in its innards. Outwardly, you can still tell that it's a Merc, but there isn't a single bit of its sheet-metal skin that hasn't been changed.

In short, the dependable Merc, always a bridesmaid but never a bride in the popularity polls, is all-new.

The length of the Monterey and Montclair series is up almost five inches to 217.8 and that of the Park Lane almost three inches to 222.8. Heights and widths have dropped a smidgen.

The recognizable touch in the styling is that long scallop on the side, now stretching from tail light to windshield post. Roofs are shorter, windshields and back windows (on the hardtops) deeper. Sedans sport wraparound windows with overhung roofs. Practically the entire width of the windshield is swept by parallel-operating wipers.

Mercury's sales people have come up with a tongue-tickler to explain a big expansion of the driving compartment—Cockpit Claustrophobia. To prevent it, that is.

Drive-shaft tunnels are lower and narrower, and that was quite a trick—they had to move the engine and transmission forward 3¾ inches. Part of the increase in the car's overall length is a result of that.

New springs discourage diving on panic stops. Rebound bumpers on the springs are of butyl rubber, an industry first, for less bounce. Engines—believe it or not—actually are, for the most part, lower in power. Last year they ranged through four choices from 312 to 400 horsepower. Now, with four choices, they start at 235 horsepower and stop at 345.

In answer to that old, irritating question, "Why can't cars have power steering with lots of gumption for parking and just a little on the highway?" Merc has done something for '59. Its power-assist on the open road is less than a third that afforded to park. Gives more "road sense" to the wheel and reduces a tendency to oversteer at cruising speeds.

Here's how it's done: All power-steering units use engine-driven pumps to force oil under high pressure into actuating cylinders that help turn the front wheels. Mercury bypasses all but 200 p.s.i. of this pressure at cruise. But when tires begin scrubbing hard, as in parking, the

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bypass valve closes, and pressure shoots up to 700 pounds. Result: more help on the steering wheel.

There were a couple of items in the 1958 Merc that the 1959 edition hasn't got. Like the Edsel, no air springs. Like the Edsel, no pushbutton drive.

That's about as much as the new Mercury has in common with the Edsel.

Lincoln, Continental
pamper the plutocrat

The cars with the strongest product identification in Ford Motor's stable for 1959 are the Lincoln, the dowager queen, and the Continental, the prince charming. It takes a cost accountant's eye to detect the styling changes.

These vehicles were meant to be that way. Year-to-year alterations in the configurations are subtle by decree of Ford's top brass, sitting in their carpeted offices in what is known universally as The Glass House, on Dearborn's American Road.

The Lincoln, by decree, is a "heritage car," the Continental an "extra-fine car." Both terms imply a royal disdain for the ebb and flow of styling tides. Both cars use substantially the same body shell.

For '59, that sculptured portion of the front fenders extends rearward a few more inches. Grilles and bumpers are new. So are back ends. Differences in the rest of the exterior appearance depend on small changes in chrome ornamentation.

Interiors are, of course, the glory that was Greece and the grandeur that was Rome.

Springs and shocks are softer. A few pounds have been cut from the weight of both cars. Both are two inches shorter—which still leaves them unchallenged as the world's longest standard automobiles.

Both have made progress in whipping mountainous problems of torsional bending and body drum created by the change last year to frameless construction. Both use the Mercury family of engines. Both have the expensive little touches—such as a magnet in the fuel filter to keep damaging metal particles out of the cylinders and crankcase.

For the Continental, the chief news is the addition to its line of a limousine and a "formal sedan." END

Brain Busters

The Case of the Missing Trains

PLAGUED by insomnia, a retired trainman often woke up at odd hours and walked down to the grade crossing. Here he would stand until a train thundered by, and then return home ready to sleep.

After a while he noticed that most of the trains he saw were going east, and very few west. But he *knew* that the line carried an equal number in both directions, alternating regularly, one each way every hour.

A close check over several months, during which he was careful to arrive at the crossing at random times, never twice the same, showed that of a hundred trains, 75 went east and only 25 west. Finally he went to his doctor, much worried.

After a checkup, the doctor pulled a timetable from his desk. "Your only trouble is mathematical," he said. "In this is the perfectly logical reason you see three times as many trains eastbound as west."

ANSWER: "You see," continued the doctor, "the trains run regularly but you arrive at odd times. Now, there is an eastbound train every hour on the hour, a westbound train a quarter past every hour. Should you arrive at 1:01, the eastbound will have passed and you will see the 1:15 westbound. But if you arrive after 1:15, you will see the next or two-o'clock eastbound. Going as you do at random, your chance of arriving during the first quarter hour and seeing a westbound is only one-third that of arriving in the last three-quarters of any hour and spotting an eastbound. Feel better?"

"Thanks, Doc," said the trainman. "You're as good with figures as with pills."

Adapted from Puzzle-Math *(Viking Press). Copyright, 1958, by George Gamow and Marvin Stern*

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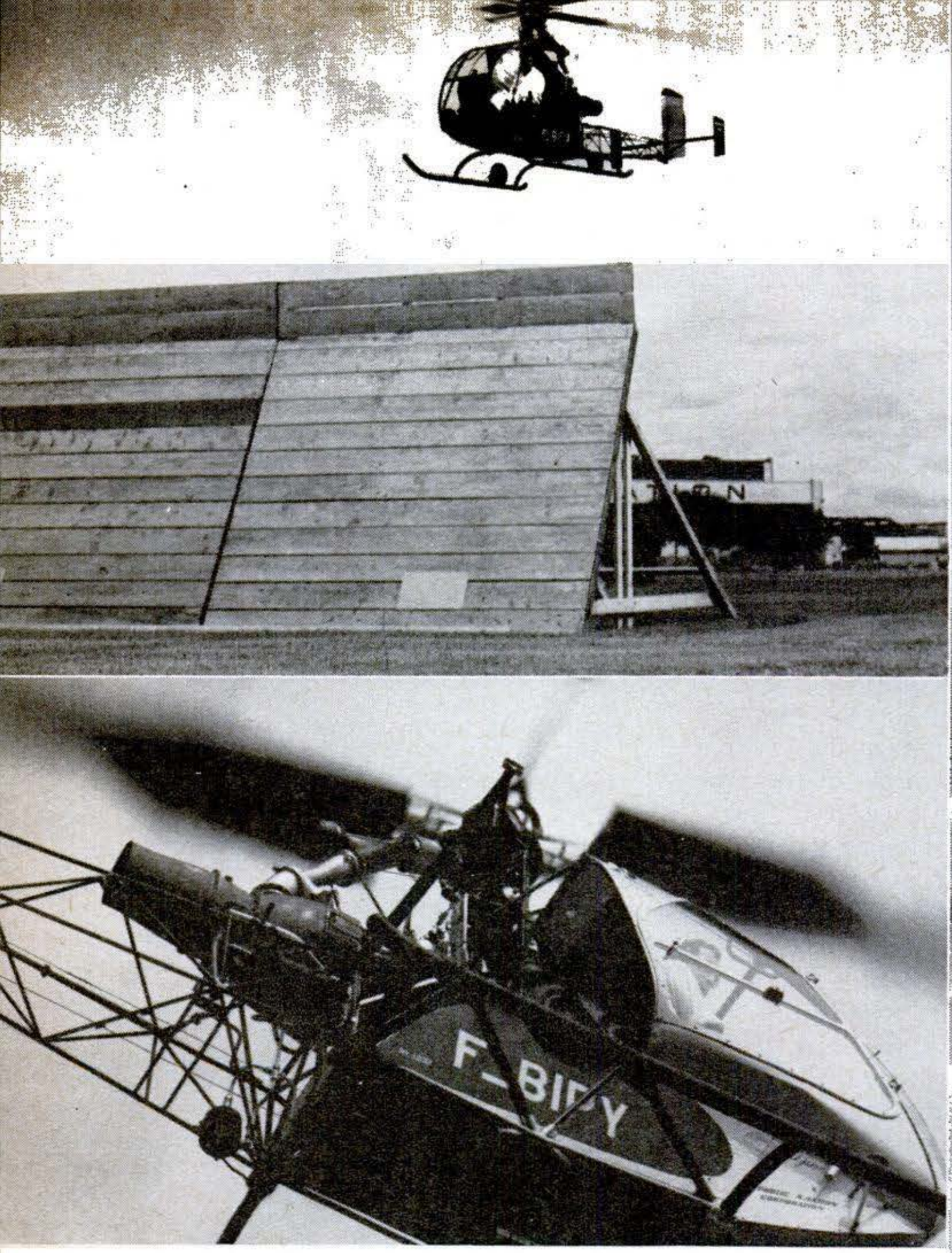

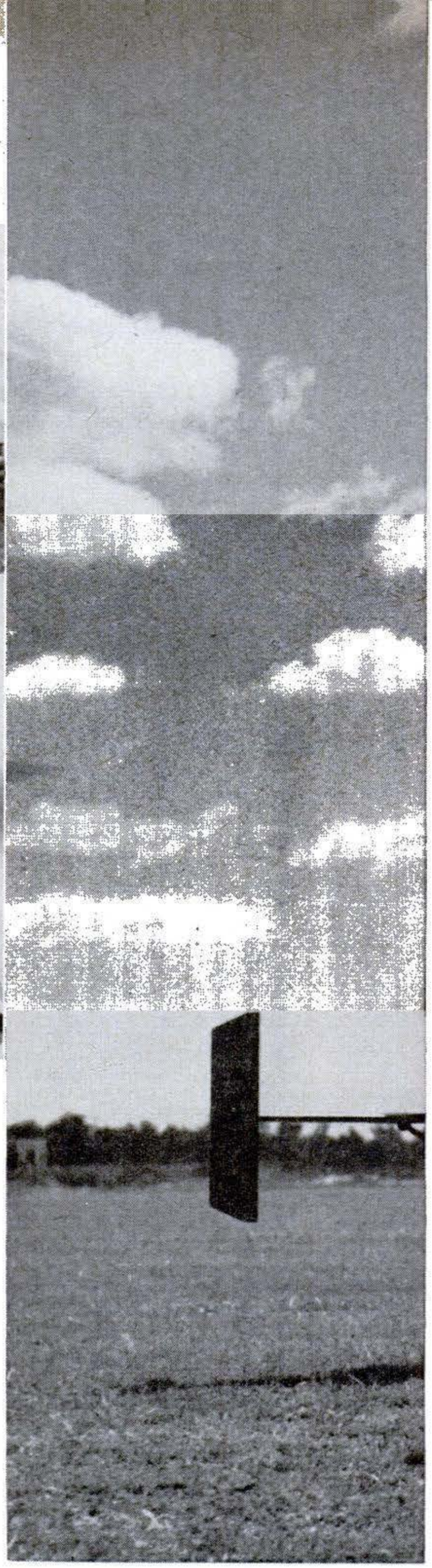

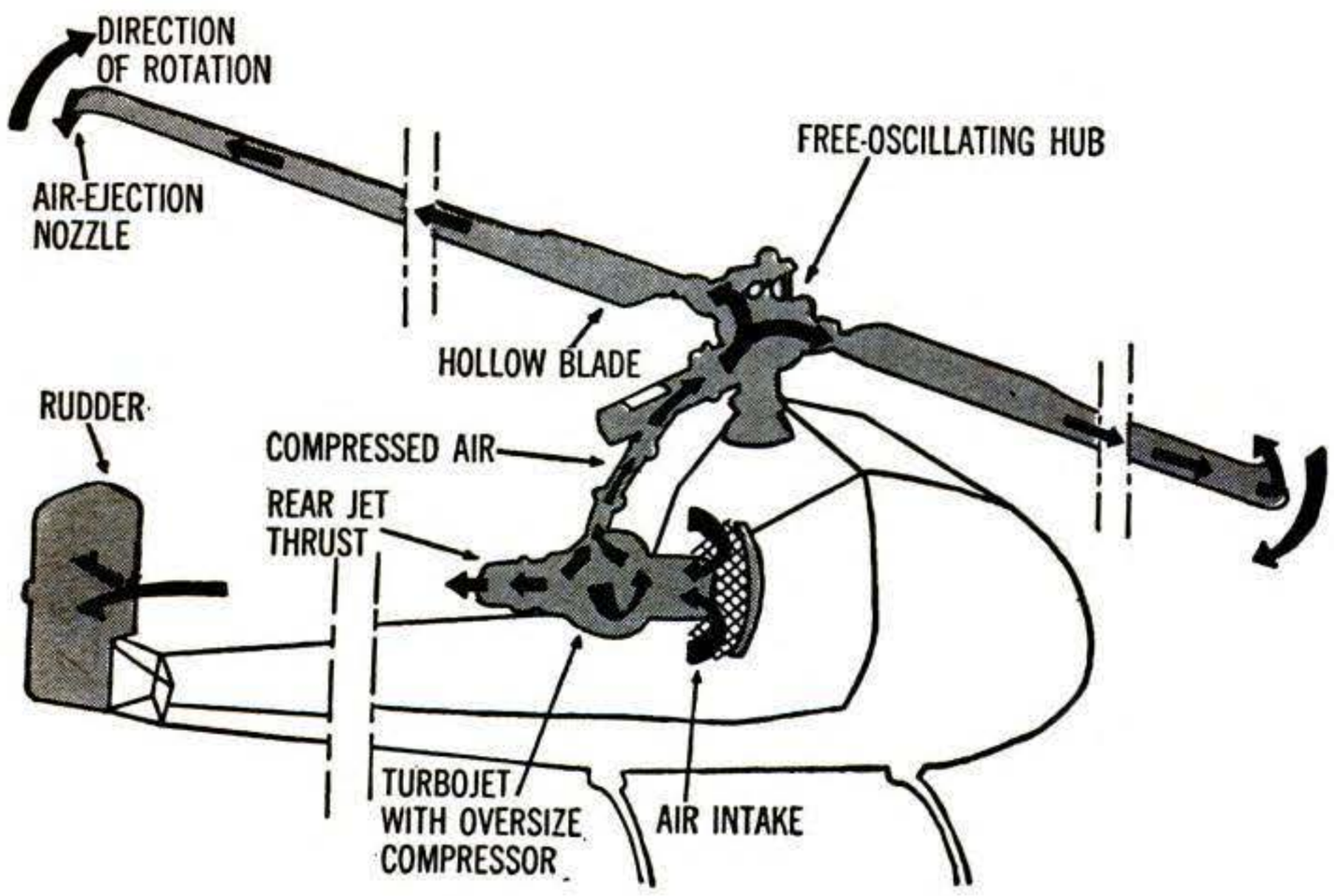

60 m.p.h.—straight up. This little French two-seat jet whirlybird climbs 6,000 feet a minute. Sud Aviation's Djinn (Little Devil) cranks like a Model T, has no electrical system and no transmission. It works like a lawn sprinkler, shooting compressed air instead of water out of rotor-tip

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What's in the Air

PLANES · ROCKETS · MISSILES

nozzles. It can land on and take off from a moving truck, jump fences (top left), cruise at 81 m.p.h. Its turbojet engine (center and drawing) discharges a rear jet to add forward speed and help steer by deflecting the blast off the rudder. Republic Aviation holds the U. S. license.

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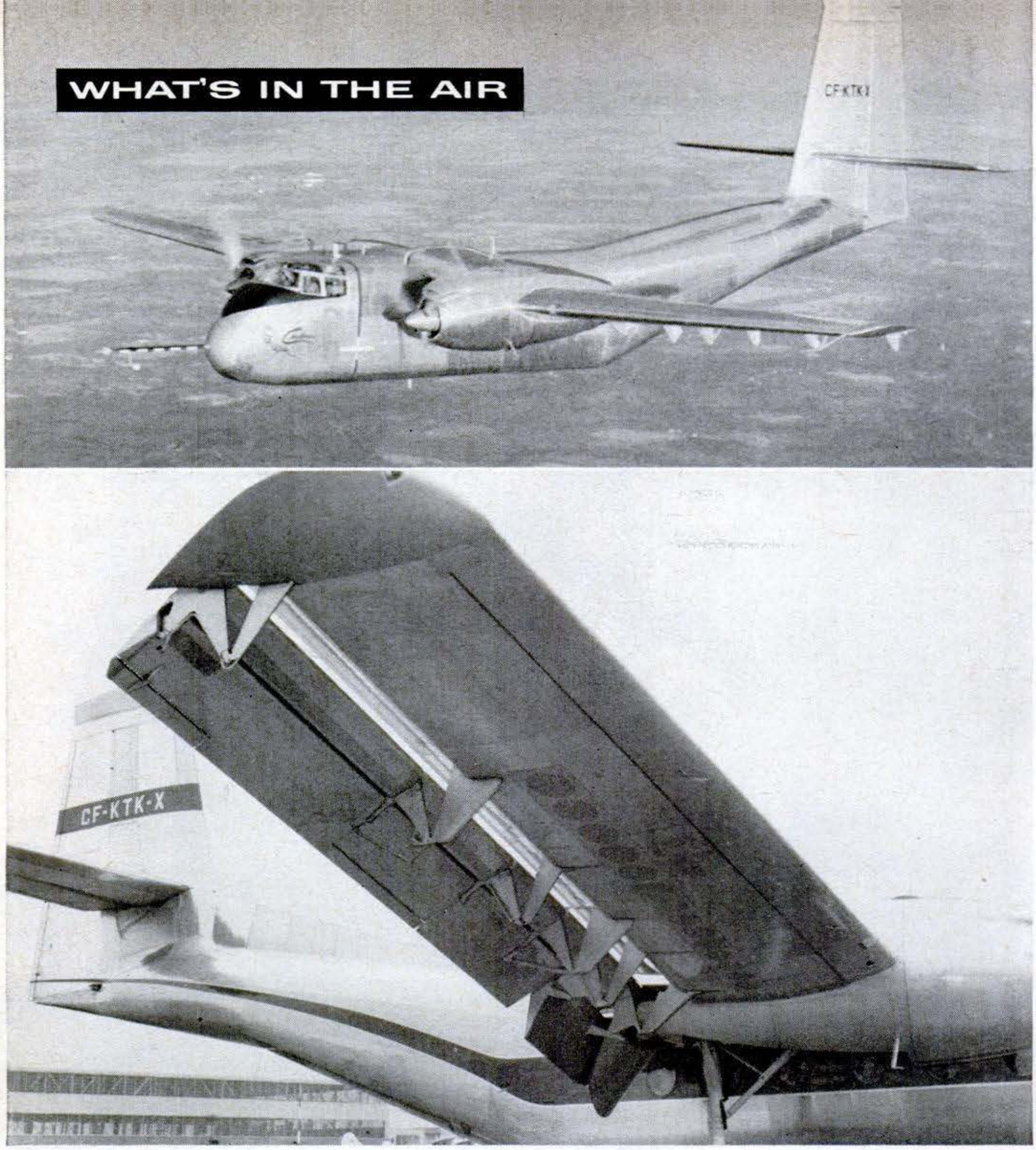
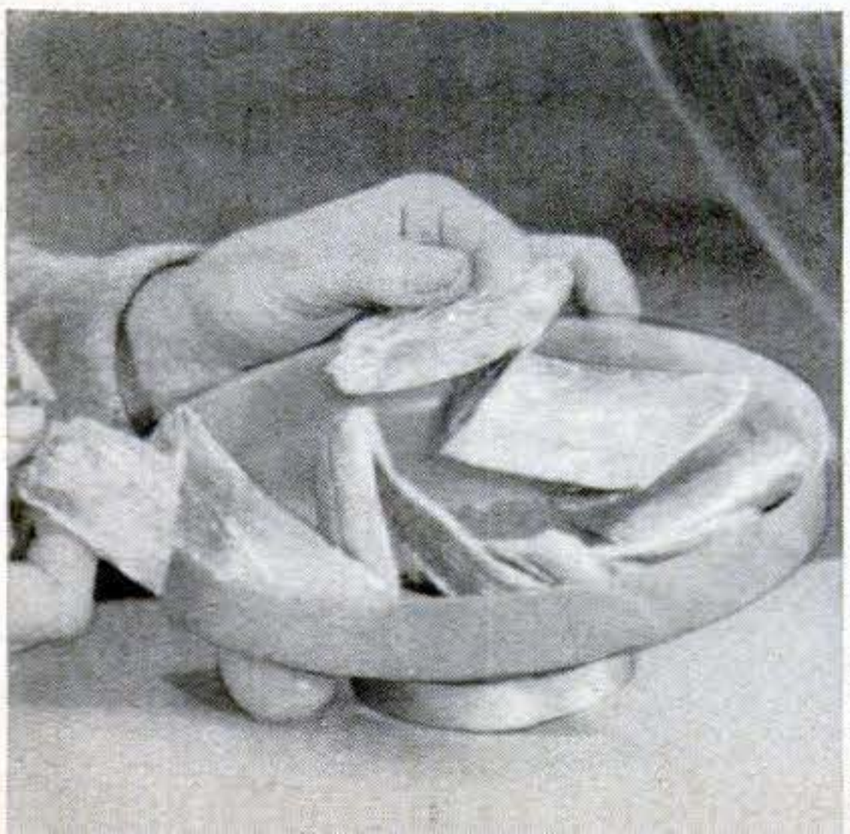
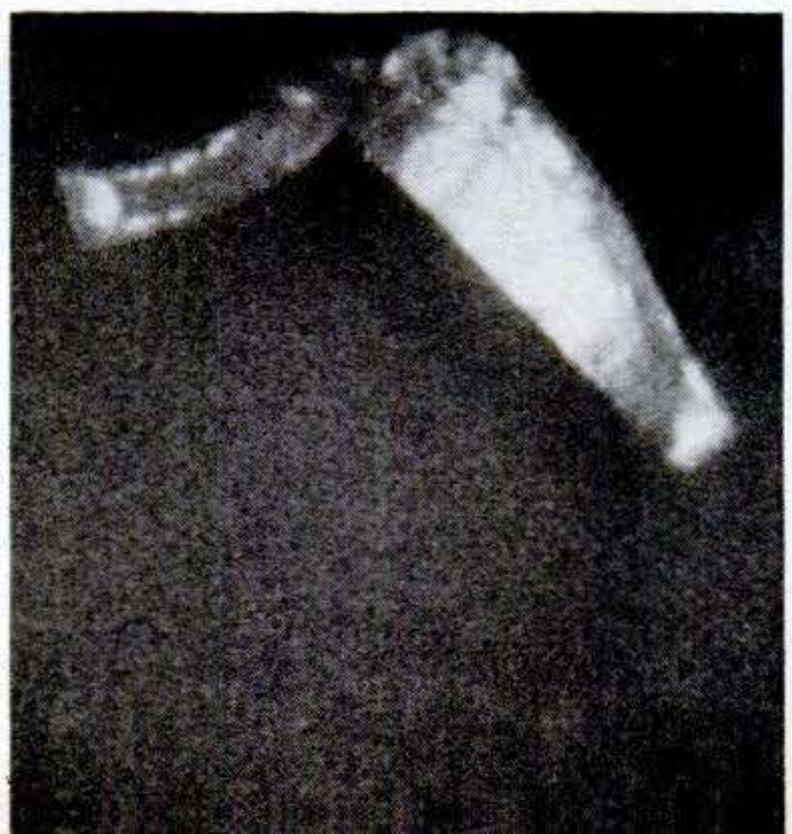
WHAT'S IN THE AIR



Short-field plane. This Canadian Caribou, shown on its first flight, has double wing flaps to enable it to take off and land on short runways, beachheads and jungle strips. De Havilland designed it for both commercial and military use. The U. S. and Canadian armies are testing it.

Collapsible satellite. Here's how an aluminum satellite [PS, July] looks when let loose in space from a rocket nose cone. Tested in a vacuum chamber at the National Aeronautics and Space Administration lab-





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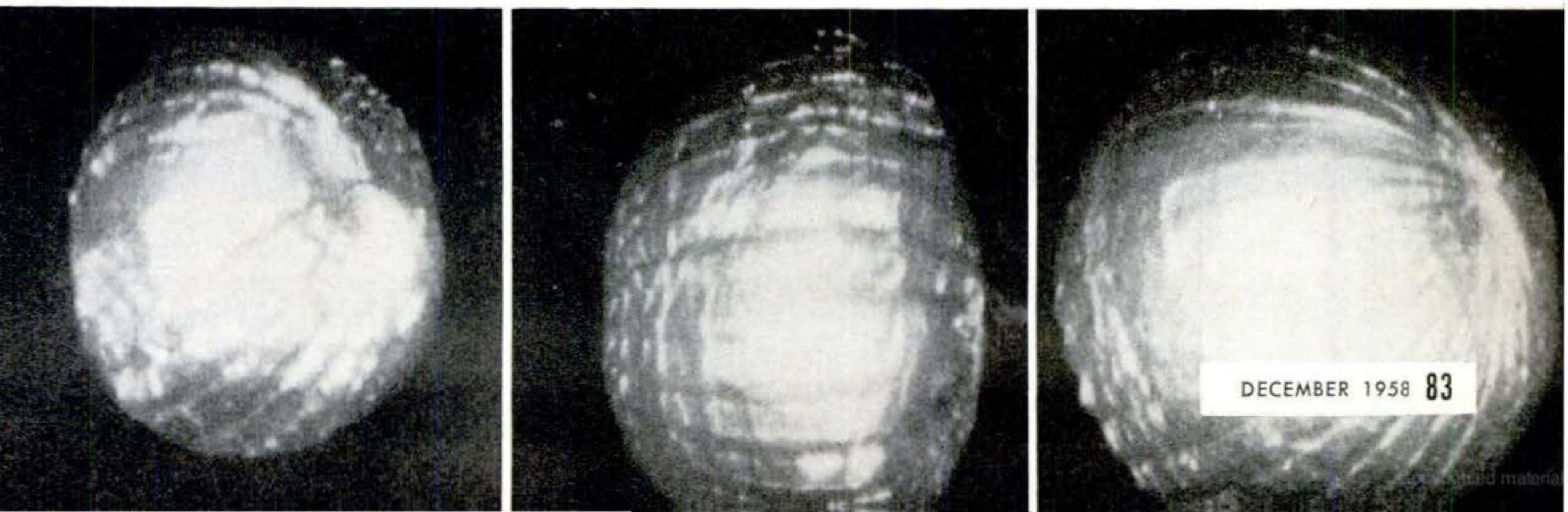
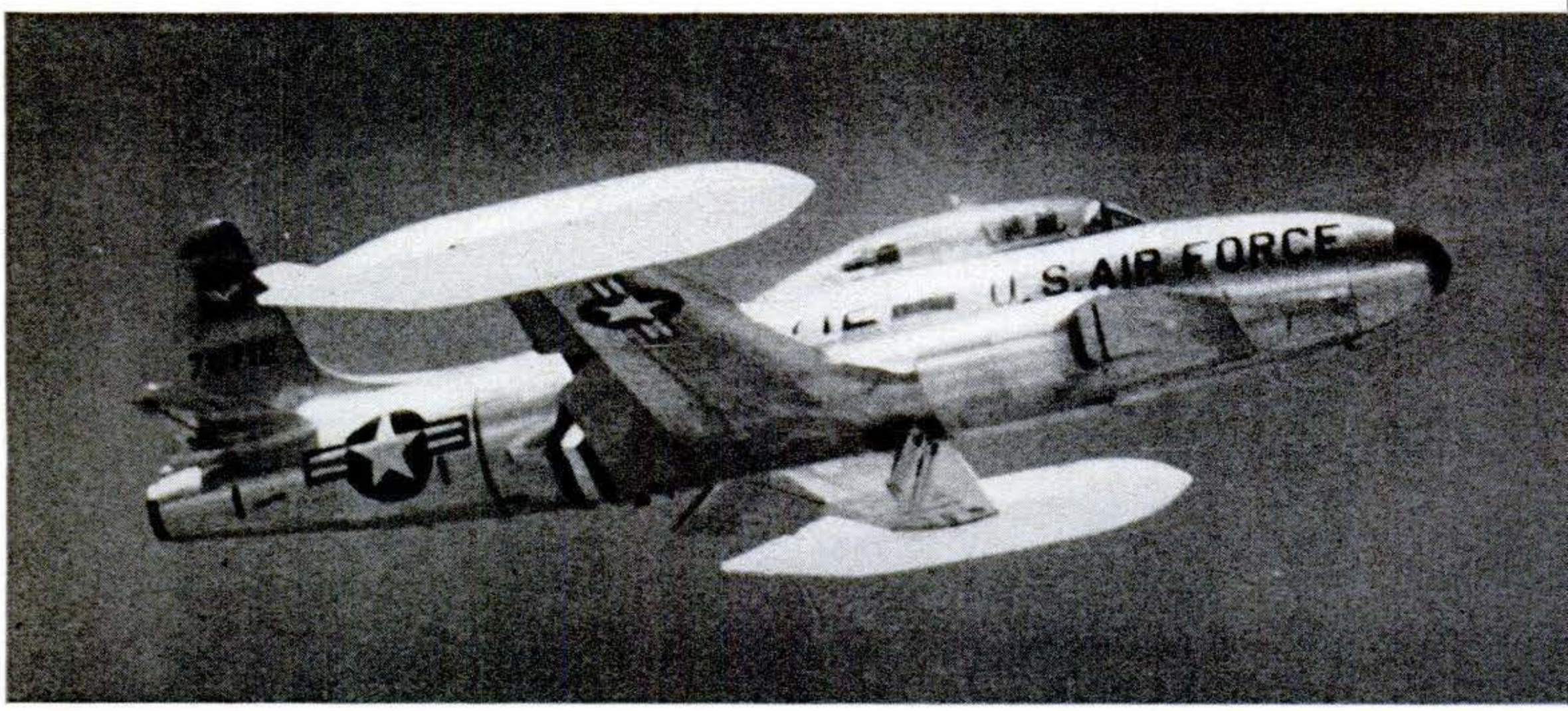
Landing craft. The Navy's big P6M SeaMaster jet seaplane has grown wheels. Taxiing up to a new beaching vehicle (top photo), it pulls itself out of the water and up on shore (center) under its own turbojet power. Lower photo shows arrangement of pressure tanks that grip the hull's sides.

oratory at Langley Field, Va., the foil-coated plastic sphere is shown collapsed and as it is ejected and inflated by nitrogen. It will serve as a radar target and to measure air density and other characteristics of space.



Aerial road map. Passenger helicopters of New York Airways, flying in dense metropolitan air traffic, are testing an all-weather navigation device. On the pilot's instrument panel is a map that unrolls and a horizontally moving stylus that traces his course. The Bendix-Decca navigator receives its information from four ground radio stations.



Glow in the sky. Prominent fluorescent markings, like the blaze-orange Day-Glo on the wing-tip tanks of this Air Force jet, are being tried in an effort to reduce mid-air crashes. Air Force nontactical and training planes and CAA craft are now marked with the highly visible paint.

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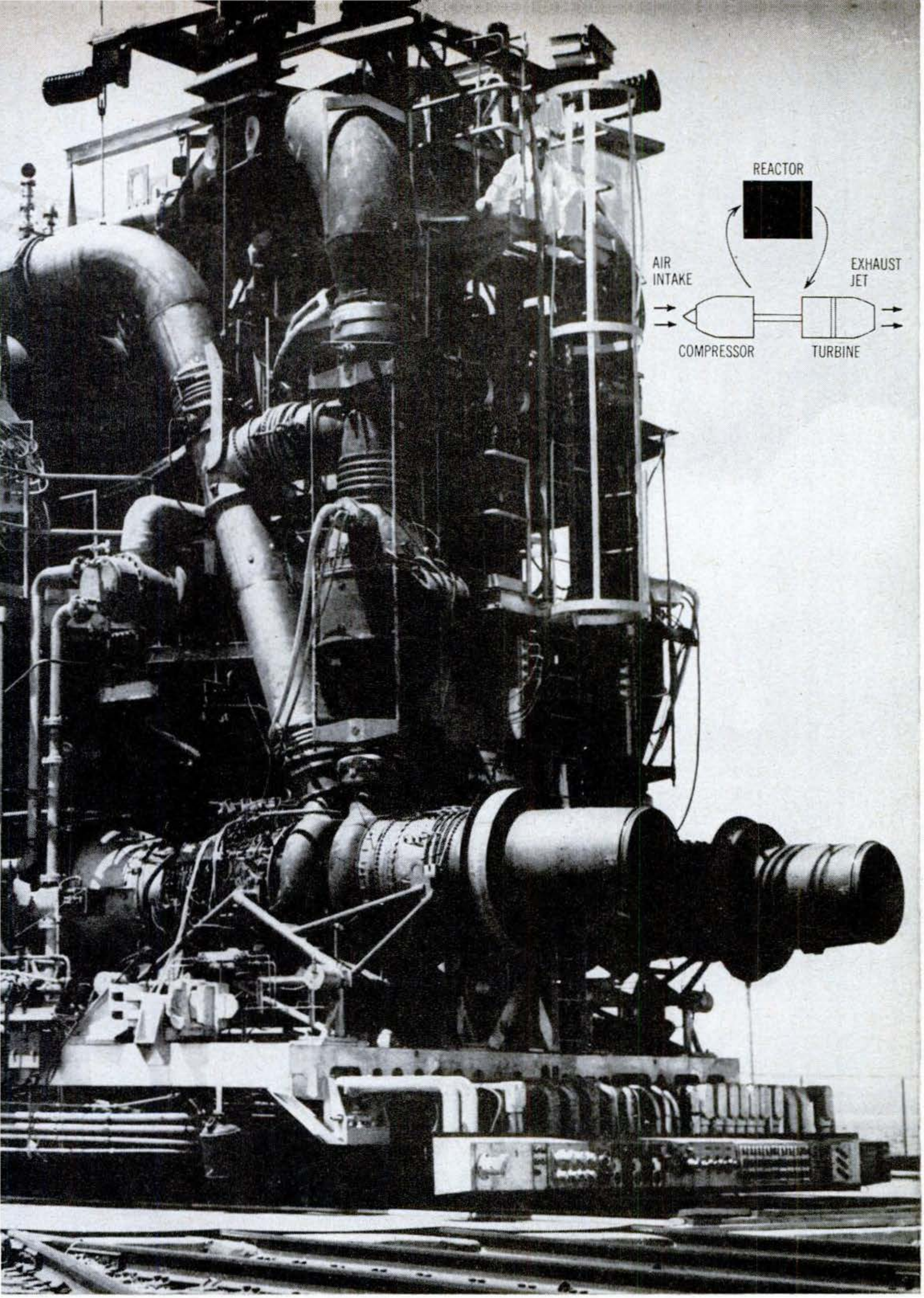

Nuclear-driven jets. First photograph of the Idaho Falls reactor shows it in use for GE experiments with atomic propulsion of aircraft jets. Air sucked into a jet's intake is heated by the reactor, instead of in a combustion chamber, and is exhausted through the turbine.

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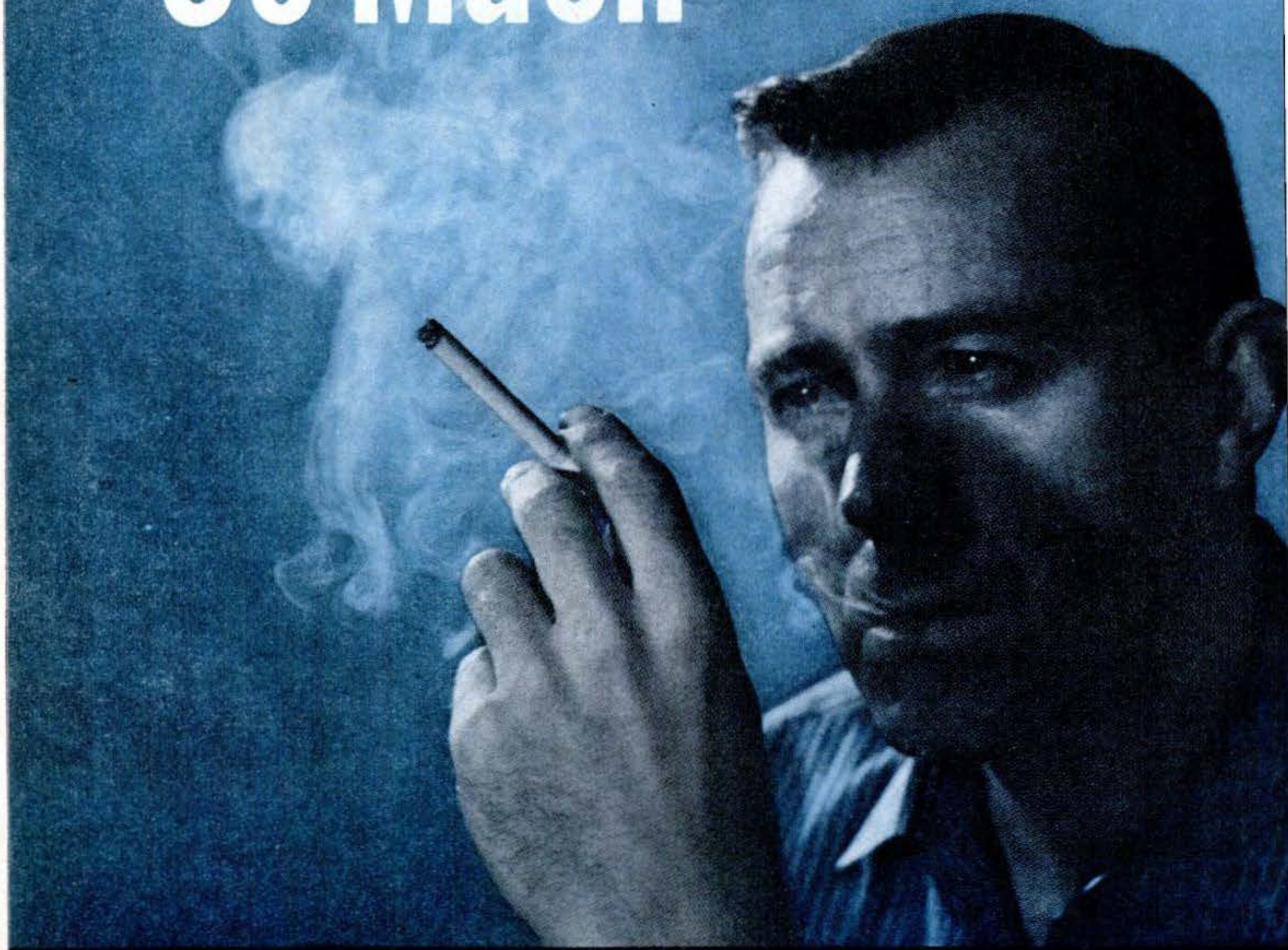
Why We Smoke So Much



Strangely neglected during the cigarette controversy, the nicotine habit itself is now coming under intensive scrutiny. What has already been learned about physical and psychological aspects of smoking will fascinate you

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By Herbert Yahraes

AMERICANS will this year light up more than 420 billion cigarettes—an inconceivable figure. Nobody knows for sure how many smokers there are in the country, but a common estimate puts the number at 65 million. This, if true, means that every day of the year 65 million Americans will consume an average of 18 cigarettes apiece. This remarkable volume—an all-time high—has been reached in the face of black headlines about statistical relationships between smoking and such leading causes of death as cancer and heart disease.

What's known about the smoking habit?

Though it has been spreading ever since Columbus discovered it in America, the nicotine habit has long been one of man's puzzling pieces of behavior. Lately, physiologists, biochemists, pharmacologists, and doctors—spurred by grants from a worried tobacco industry—have been learning much about the drug that gives tobacco its kick. Psychologists, moreover, have been studying the root problem of *why* people smoke. This article, based on the most recent findings, tries to sum up today's knowledge. When it talks about smoking, it means the inhaling of cigarettes, for just about all recent experiments have been concerned with that type of smoking.

Does inhaling make a difference?

When you inhale a cigarette, you take in from 75 to 90 percent of the nicotine in the smoke, most of it via the lining of your lungs. If you don't inhale, you take in as much as perhaps 25 percent, through the lining of your mouth. The verdict on the effect of filters isn't in yet; some of them do reduce the amount of nicotine absorbed, but tests indicate that your body reacts even to small amounts.

With the first puff or two, nicotine goes to work on your autonomic nervous system. Certain nerves order the heart to work faster. Then along comes adrenalin—the hormone that stimulates us in an emergency—to reinforce the order. Some of it apparently comes from a supply stored in the heart itself; the rest comes from the glands that make it. The heartbeat rate goes up, from five to 20 strokes more a minute. The

Who Are the Authorities?

Among the experts consulted in connection with the accompanying article were:

Dr. McKeen Cattell, professor of clinical pharmacology, Cornell University Medical College.

Dr. Dale G. Friend, assistant professor of medicine, Harvard Medical School.

Dr. Robert C. Hockett, associate scientific director, Tobacco Industry Research Committee.

Dr. Charles C. McArthur, psychologist to the Harvard University Health Services.

Dr. Leonid S. Snegireff, associate professor of cancer control, Harvard School of Public Health.

Of these, one has been smoking a pack a day for many years; one gave up his pipe and cigars years ago because he had sinus trouble and smoking seemed to make it worse; one, who took up smoking in order to put students at ease when he had to give long oral examinations, smokes cigarettes occasionally; one smoked a little in college but never really cared for tobacco and soon quit; and one smoked a pack a day but quit in 1947 because of hoarseness and a cough.

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strength of the beat also increases somewhat in most cases.

Spurred by the nicotine, other nerves constrict the superficial blood vessels of the extremities. Less blood flows through these vessels, and the skin temperature drops. Your fingers and toes become cooler—most likely just a few degrees, but in some people as much as eight or more degrees. (A sudden noise can have the same effect, or drinking a glass of cold water.) Blood pressure jumps, too: less than 10 percent in some smokers, more than 20 percent in others. All these changes last for perhaps 15 or 20 minutes.

What other things happen?

Nicotine staves off hunger, in some people at least, by temporarily blocking the stomach's hunger contractions. At the same time the extra adrenalin stimulates the liver to release some of its sugar, so that you feel less urge to eat. In healthy people the nicotine probably has little effect on the digestive system. If you need a morning cigarette for regularity, as many people seem to, it's probably only because you got into the habit.

Nicotine does affect kidney action. In one experiment university students drank a lot of water and then, 45 minutes later, smoked a cigarette or two. Abruptly their excretion rate dropped. Most of the habitual smokers needed two cigarettes to bring on this slowing-up effect; most of the nonsmokers, only one. The effect, which lasted from 45 minutes to three hours, has been traced to the action of a hormone secreted by the pituitary gland.

Any effect on the brain?

Presumably not. One researcher is studying blood flow in the brain. This measurement is important: Blood carries the oxygen and nourishment needed to keep the brain functioning well. In young people, smoking seems to bring no change. The work on older people is not yet complete.

Does smoking cut your wind?

In some people with lung ailments, smoking a cigarette increases for a time the work of breathing. For healthy people the evidence is contradictory. A recent experiment suggests that smoking may lower the rate at which the blood takes up oxygen after exercise.

Smoking brings on these other quick results:

- An increase in the secretion of saliva.
- A slight irritation of the mucous membranes of mouth, nose and throat.
- A slight interference with the senses of taste and smell.
- A substitution of carbon monoxide for a little of the oxygen in the blood—which might be important if you are anemic.

These are the only known immediate effects upon habitual smokers. Perhaps you remember some others from your youth—pounding of the heart, dizziness, nausea. But these soon passed. If you as a youngster persisted in smoking, the body quickly accustomed itself to the nicotine.

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What makes smoking a pleasure?

The immediate physical effects suggest that it has a mildly stimulating action. Most smokers, though, testify to a soothing or relaxing effect. Physiologists don't know where this comes from. Psychologists have a lot of theories:

1. Smoking gives "oral satisfaction"—the same kind we once got from nursing, thumbsucking or chewing on a pencil. One psychologist reports that those in a certain group of men who had most difficulty in giving up smoking were the ones who had been weaned very early.

2. Smoking helps smooth social relationships. We don't have to just sit and wonder what to say—or what to do with our hands. We can take out a pack, pass it around, snap open a lighter, look for an ashtray, and so on.

3. Smoking gives us time to think. Catch a man in a crossfire of questions, and chances are he'll light up a cigarette before answering.

4. Smoking gives us an excuse to rest. Neither the boss nor our own conscience may let us stop and do nothing. But neither will object, perhaps, if we stop and light a cigarette.

5. Smoking, by giving us something to do, helps to ease tension while waiting—for H-hour, for an airplane, for news from the delivery room.

6. Smoking is fun. It makes us feel we are good enough to enjoy one of life's little luxuries. It also enables us to continue playing with fire.

So smoking does relax, does give pleasure, does offer a temporary solution to certain problems. Psychologists say that's why, having begun smoking, probably to demonstrate that we are grown up, or part of the gang, we tend to make it a habit—so powerful with many as to be reflexive.

Is smoking a habit or an addiction?

Tobacco usually remains a habit, rather than an addiction. The difference? If you are *addicted* to a drug, you feel compelled to take it, and you are usually dependent on it physically as well as psychologically. Further, the addiction is bad not only for you but for society. If you have a drug *habit*, on the other hand, you may have a strong desire to keep using it but are not compelled to do so. You are not physically dependent on it. And while the habit can hurt you, it has little effect on society.

For most people smoking is merely a habit; for some heavy smokers, it can approach addiction. A few people, warned by their physicians that continued smoking would in their cases imperil their health, have actually died rather than give up tobacco.

Do the effects of smoking pile up?

If you're healthy, the immediate physical effects of smoking are neither especially good nor especially bad.

It's a fact that nicotine taken in excess is a poison. A drop on the skin would kill a cat, and a pack-a-day inhaler who got his daily intake of nicotine all at once might be dead in minutes, his respiratory system paralyzed. But the

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body handles smaller doses with great efficiency. It excretes almost all the drug, in the urine, within 24 hours. Even the heaviest smoker cannot accumulate a fatal dose.

What scientists would now like to learn is whether or not any of the immediate effects pile up over the years to the detriment of your health.

In two conditions there is evidence that they do—in certain individuals. One is "smoker's asthma" or "smoker's respiratory syndrome." This is marked by wheezing, coughing, hoarseness, frequent sore throats, chest tightness and pains, a tendency toward colds, and in some cases shortness of breath. The symptoms go if the patient stops smoking.

The second is an eye condition known as tobacco amblyopia, in which there is a dimness of vision followed by loss of the ability to see colors. The exact role that tobacco plays —if any—is disputed, but many ophthalmologists believe that in a few sensitive individuals nicotine affects the retina. Amblyopia, which is, luckily for smokers, fairly rare, is *not* brought on by the red, watery condition sometimes caused by tobacco smoke.

What about cancer and other diseases?

The U. S. Public Health Service, for example, has reported that among veterans who died from lung cancer over a certain period, about 10 times as many had been smokers—cigarette smokers—as non-smokers. USPHS has also reported that the death rate from coronary heart disease among cigarette smokers was almost two-thirds higher than the rate for non-smokers. In cigarette smokers the death rate from all causes was more than half again as high as among non-smokers. Such findings raise a lot of questions, including why most cigarette smokers *don't* get lung cancer.

Recently a little light has been thrown on the relationship between smoking and heart trouble. Nicotine certainly makes the heart work faster; the question is, does the heart get the increased oxygen and nourishment it needs to perform this extra work without strain?

Experiments with volunteers from the Alabama state prison system seem to say *yes*. Smoking *increased* the flow of blood through the heart's own arteries, the coronaries. But these volunteers had sound hearts, and another experiment—with rabbit hearts—suggests that the flow of blood does not increase if the arteries have become hardened. So there is the possibility that when coronary heart disease has set in, smoking increases the load on the pump but not the blood flow needed to handle the load. To find out, tests are being made on human beings.

One theory often advanced to answer the questions raised by the statistical findings about smoking and disease holds that:

- Some people are more sensitive than others to the effects of tobacco.
- A time may come after years of smoking when the ability to handle tobacco decreases, and
- Trouble may show itself at this time in a number of different ways.

[Continued on page 224]

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"I'd like to see them make..."

AN EASIER OIL-CHANGING SYSTEM on cars. Put an electric pump on a drain line leading to an outlet on a fender and it would be easy to service your own car.—*Paul LeBrun, Salem, Mass.*

FILM-IDENTIFICATION TABS you could stick to your camera as a reminder, later, of what film you had inside and its speed. The tabs could also seal the rolls.—*Mrs. A. E. Opper, Brooklyn, N.Y.*

CORDLESS CHRISTMAS-TREE BULBS that could be spotted at random. They'd operate off radio-frequency currents transmitted by a device like a Tesla coil.—*K. L. Swinth, Seattle.*

A DUFFEL-BAG CARRIER for servicemen. Similar to the small two-wheeled carts used for golf bags, it would fold for storage inside the bag. —*C. K. Adams, Manhattan, Kan.*

EARRING ACCOMMODATERS for phone receivers so women wouldn't have to remove an earring to hear properly. A U-shaped foam-rubber pad might do.—*Catherine Gundling, Covina, Cal.*

Everyone has his own pet idea of a gadget that he would like to see in general use. The five ideas illustrated above were suggested by POPULAR SCIENCE readers. What's *yours?* We will pay $5 for each one published. Please use Government postcards only. Write name and address clearly. Contributions cannot be acknowledged or returned.

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INFRA

MISSILE DETECTOR

New discoveries about "invisible light" promise medical diagnosis, weather forecasting,

RIGHT now infrared looks like the hottest prospect to solve the exceedingly tough problem of how to detect an intercontinental missile in outer space.

Part of this new importance of IR—as it's abbreviated—depends on a surprising finding made by physicist Myron Block on the roof of the Smithsonian Astrophysical Observatory in Cambridge, Mass., the night of Oct. 14, 1957.

It was just 10 days after the advent of Sputnik I, and Block, head of a small Cambridge research firm, had hastily cobbled together a special IR detection system. Could he detect the satellite by means of its infrared emission even while it was in the darkness of the Earth's shadow? There was a bare chance this would be possible.

To his astonishment, he found that the satellite not only was de-

What Is Infrared?

INFRARED (IR), sometimes loosely called "heat rays," is the electromagnetic radiation that fills the part of the spectrum between visible light and radar. It covers a range from roughly 0.7 microns in wave length, where it merges into red light, to 300 microns, where microwave radar begins. (A micron is a millionth of a meter, or 0.00003937 inch.) It subdivides into three main regions, whose boundaries have not yet been precisely settled on, but which are roughly as follows:

1. The near infrared (from 0.7 to 1.5 microns) is roughly the limit to which photographic film is useful. In this region a hot household electric iron will

 No. 5 in a series of articles exploring the new frontiers of science

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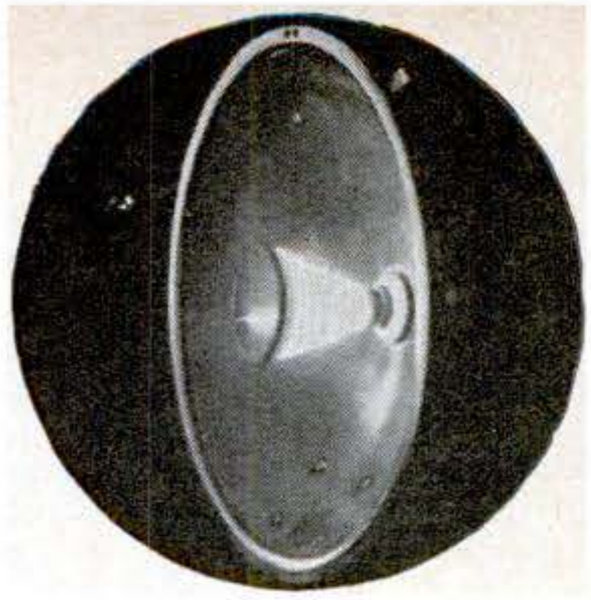

RED: AND LIE DETECTOR

startling breakthroughs in space research, home heating, criminology BY GEORGE R. PRICE

tectable, but that it was emitting more than 10 times as much IR as he had expected—as much as if it were at the temperature of molten lead. And yet it couldn't be very hot, or the radio equipment transmitting the "beep beep" wouldn't work.

What could this mean? Block repeated his measurements many times on Sputnik I and some of the later satellites, and he kept finding the strangely high infrared radiation—in the case of Sputnik III amounting to thousands of watts. His present theory: It's related to ions and electrons, present in space, that combine on the surface of the satellites.

This finding, if borne out, changes the whole picture for missile detection. Previously it was thought that IR would be useful for detecting nose cones heated white hot from atmospheric friction in

glow with its own "light" but objects at body or room temperature must be illuminated by an infrared light source like the searchlight of a Sniperscope.

2. The middle infrared (from 1.5 to six microns) has many important military uses. The jets of jet planes and rockets emit in this region, as do the friction-heated surfaces of transonic planes and missiles. Hence infrared-guided homing missiles like the Sidewinder "see" mainly middle infrared.

3. The far infrared (from six to 300 microns) includes regions where objects at room or body temperature radiate most strongly, so this region is used for "heat pictures." Unfortunately, however, detection of this long-wave IR is comparatively difficult and most detectors have low sensitivity in this region.

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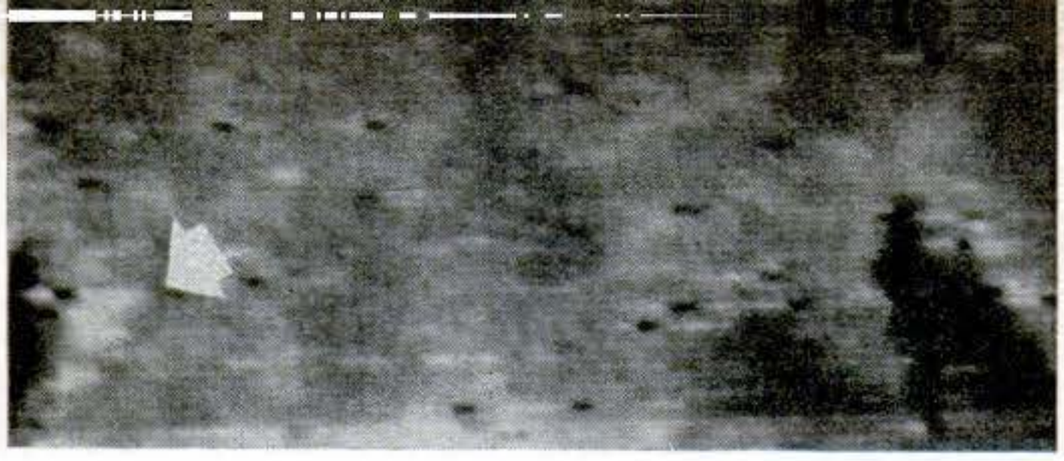

Medical diagnosis is one of most promising uses of infrared photography. Here a breast tumor—warmed by generous blood supply—is revealed by white area (arrow).

re-entry, but IR did *not* look promising for detecting a missile in outer space. Now Block's discovery suggests that an IR detector unit costing a few thousand dollars may be able to detect an ICBM as far away as a radar station, costing hundreds of thousands, could.

When this work was reported in the newspapers, however, there was no big rush to start building an anti-missile IR network. The trouble: The reports simply didn't seem believable. Where could the energy be coming from? It wasn't until Explorer I was orbited last February that U. S. scientists learned that there are zones of high-energy particles surrounding the earth.

Furthermore, Block's modest organization—with just a cluttered lab and workshop occupying the first floor of an old wooden house—didn't seem the sort of place from which such an important discovery could come. If it had been one of the big companies in the IR field, like Perkin-Elmer, Electronic Corporation of America, Barnes Engineering, or any of a dozen others, things would have been different. But Block Associates doesn't have any guards, personnel officers, typing pools, or pretty receptionists—only researchers. So Pentagon officials were skeptical.

Acceptance may be on the way, however. According to the highly respected IR expert Dr. John Howard, head of the Infrared Techniques Branch of the Air Force Cambridge Research Center, there have been recent confirmations of Block's findings both in the U. S. and England, and the evidence looks impressive.

So it seems likely that a few years from now there will be infrared networks corresponding to the SAGE, Pine Tree, and DEW Line radar systems, with picket planes circling high in the sky whenever cloud cover makes ground stations useless. However, some very recent British work suggests that under some conditions the extra-high IR radiation may be absent. Possibly, for example, when a satellite or missile is at certain altitudes, it finds few charged particles in space, and so glows only with the comparatively weak radiation that it emits because of its surface temperature. Hence IR networks would supplement radar, not replace it.

Advantages of IR over radar for missile detection are:

- IR equipment is much smaller, lighter, cheaper and simpler.
- IR gives more accurate information about shape and direction of an object. Thus the Sidewinder air-to-air missile, using IR guidance, can knock a flare off the wingtip of a plane without touching the wing—a feat impossible with radar.
- IR systems are much more difficult to jam or confuse by other countermeasures.
- IR should be better at great distance because the radiation has to go only half as far as radar: from the missile to the IR unit, instead of from a radar station to the missile *and* back.

Disadvantages are:

- IR penetrates clouds, mist and rain much less effectively than radar.
- IR doesn't give information about the distance and speed of an object in the simple, accurate way that radar does.

A long list of possible uses. Vitally important as missile detection is, it is still only the first in an extensive list of likely future uses for infrared. These range from a secret method of lie detection to new types of radiant-heating methods to make possible Southern architectural styles, with year-round outdoor living, in the North.

A large, important group of applications depends on taking pictures with special "cameras" sensitive in the *far infrared*. These pictures show temperature, temperature shows heat, and heat means energy. Whenever something is happening, energy is involved and heat is likely to be produced. So the pictures reveal action and energy, instead of merely showing how much light the surface of an object reflects.

For example, the picture of a car on the next page shows the heat of engine and exhaust. The handprint on the wall shows that someone's hand—alive and warm—was pressed against the wall and transferred heat to it. The portrait of the

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man with the pipe shows that the pipe is lit and the man is alive.

Let's talk about three important uses for such pictures.

Medical diagnosis. It's quite likely that 10 years from now, if equipment comes down enough in cost, an IR picture will be a routine part of every medical examination. It will be a quick way to show the doctor areas of poor circulation, inflammation, or unusual metabolic activity.

One particularly important medical use of heat pictures is in cancer detection. Dr. Ray Lawson of McGill University in Montreal has found that malignant tumors—because of their generous blood supply and high growth rate—are usually a little warmer than the surrounding normal tissue. If the tumor is close to the body surface, this small temperature difference can be detected by an infrared camera. It is easy to foresee mass programs of screening people for breast cancer or other cancer not too deeply buried in the body.

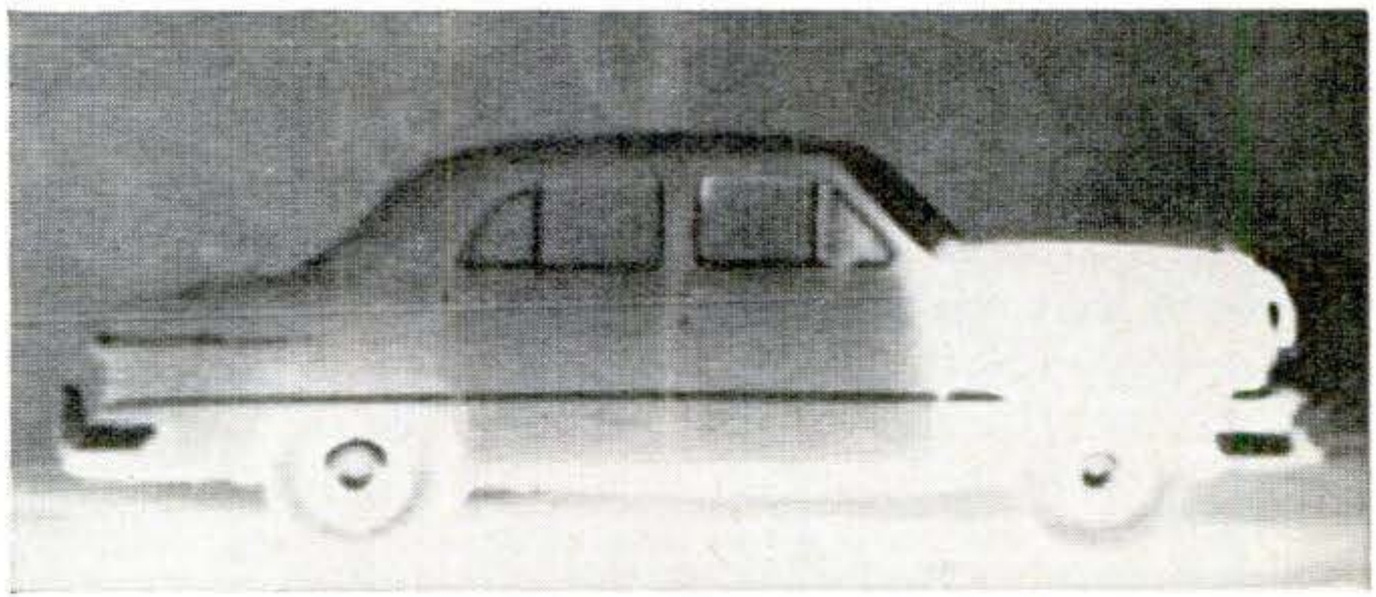
And we can imagine the army of the future with men lined up side by side for examination, and an IR instrument sweeping from one to the next, to take a whole battalion's temperature in half a minute!

Vision in the dark by far IR. Infrared provided vision in the dark even as far back as World War II, by means of Sniperscopes and Snooperscopes. But these worked by near IR, and required an infrared searchlight. They were very effective as long as only one side had them. When both sides have IR equipment, it's likely to prove fatal to turn on an IR searchlight. However, if one can "see" by far infrared, then there's no need for the betraying searchlight, since enemy soldiers and other objects emit their own light.

The IR cameras used for the pictures accompanying this article are too slow for such military uses. They require a few minutes to produce a visible picture. Much faster is the Evaporograph camera of Baird-Atomic of Cambridge, which takes only a few seconds to produce a heat picture in colored light reflected from a thin oil film. But this is still too

How infrared reveals the "invisible"

"Heat picture" of human handprint. Hand was held against a wall for three seconds; 30 seconds later, infrared radiation showed where the wall was still warm from its touch.



Infrared photo of car shows engine has been running. Hood is hot. So is ground below car, from exhaust.

Man with pipe, photographed in a dark room: Skin, warmed by body heat, and lighted pipe appear white. Color has no effect on infrared picture—only temperature.

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Infrared 'scope at MIT's Naval Supersonic Lab is adjusted for Sputnik spotting by Myron Block and Richard Freeman. Smaller instrument was used in Block's original tests.

long. What's needed is a far-infrared TV process as fast as ordinary TV.

Is there work in progress to develop a TV camera tube sensitive in the far infrared? None that anyone would talk about. But it seems a safe guess that right now the U. S. and Russia are in a secret high-priority race to accomplish this. There's no theoretical reason why such a tube can't be made, and the side that gets there first will have a real advantage in ground warfare. One side could see at night almost as well as by day; the other would be fighting in the dark.

Military reconnaissance. If we can look up at a satellite, what about the satellite looking down on us? Specifically, have the Soviets been watching us through their Sputniks?

Hints dropped in talks by Russian scientists suggest that they have, though of course no one knows for sure. But here are a few facts about infrared surveillance to help us decide:

- IR reconnaissance by airplane during World War II was by photography, which is sensitive only in the near infrared. This pierced haze better than visible light, and penetrated some types of camouflage.
- Present equipment using far infrared will be much more useful. For example, heat pictures can distinguish between a warehouse and a factory, even though both buildings may look the same under visible light, near IR, and radar. Even underground factories might be detected by hot gases released into the air, warm water entering a stream, heat escaping through the ground.
- The Soviets *could* have put IR equipment in their satellites if they wanted to. Sputniks II and III have been plenty large enough for this. And infrared cameras similar to some now available would be fast enough for satellite use.
- Articles published in U. S. technical journals suggest that the supersecret Lockheed U-2 observation plane, which relies on extreme altitude for protection, could be used for mapping and reconnaissance of Soviet territory.

The plausible conclusion is that it's entirely possible the Sputniks have been carrying IR observation equipment good enough to show the location of large cities. Almost certainly they can't now "see" fine details like individual buildings. But future Sputniks should be able to do this.

And maybe we ourselves won't be so far behind. Our Project Pied Piper is intended to provide us with a huge observation satellite—sometimes referred to as "Big Brother"—for reconnaissance of the whole world.

A much pleasanter use for satellites is to make possible really good long-range weather forecasting. Meteorological data can be obtained with much smaller and simpler satellites than the "Big Brother" type. Right now, in fact, there's an IR "Weather Eye" system ready and waiting to go aloft in the next Vanguard.

As described in POPULAR SCIENCE last June this will observe and report on cloud cover over the earth. But later weather satellites will do a great deal more. Infrared is an excellent tool for chemical analysis, using different wave lengths to measure different compounds. The more sophisticated satellites will measure ozone, water vapor and carbon dioxide; study the heat balance of the earth; and give data on wind direction and velocity based on measurements of cloud motion.

A few satellites could continuously survey the whole earth. The data would

[Continued on page 216]

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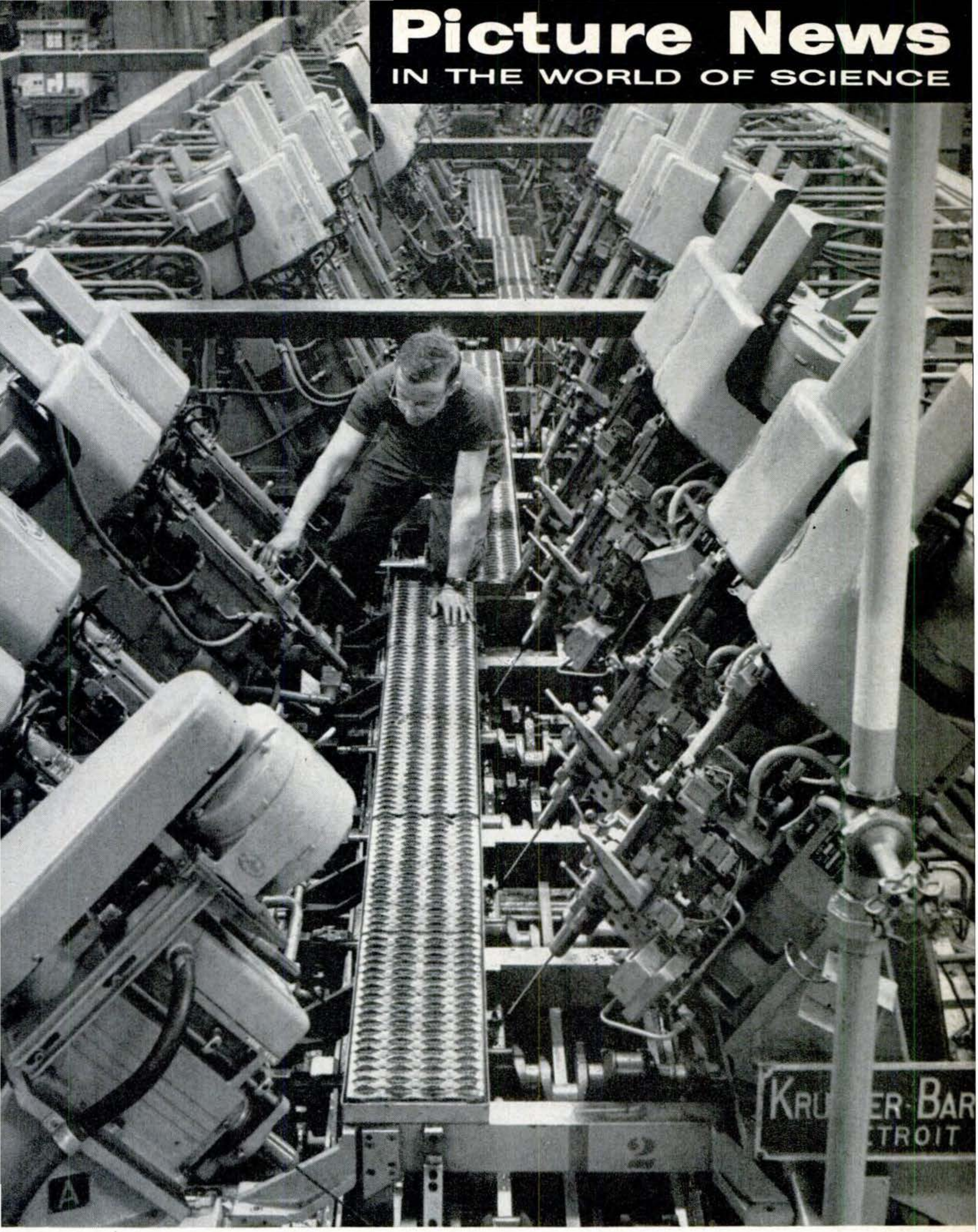
Picture News
IN THE WORLD OF SCIENCE



Auto automation. This 52-foot-long bank of special-purpose machines drills the entire oil system in crankshafts in a single continuous operation at Ford's new engine plant at Lima, Ohio. If a bit should break, the machinery shuts down, a control panel flashes, and a new bit is put in.

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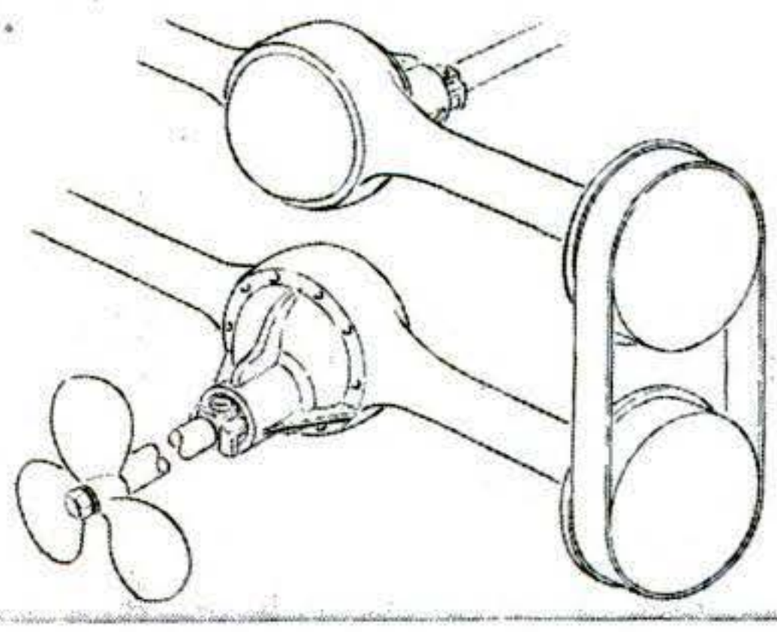
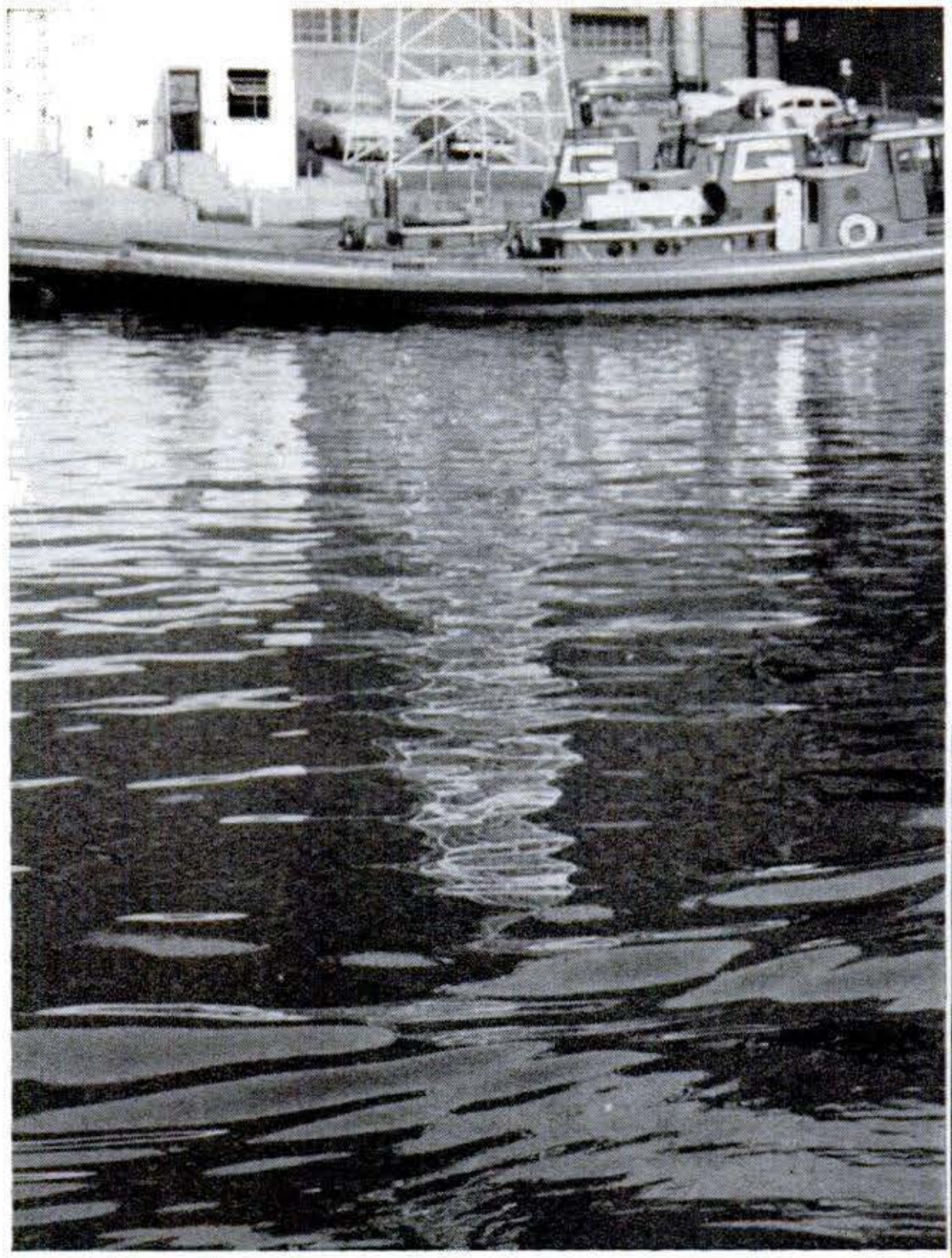
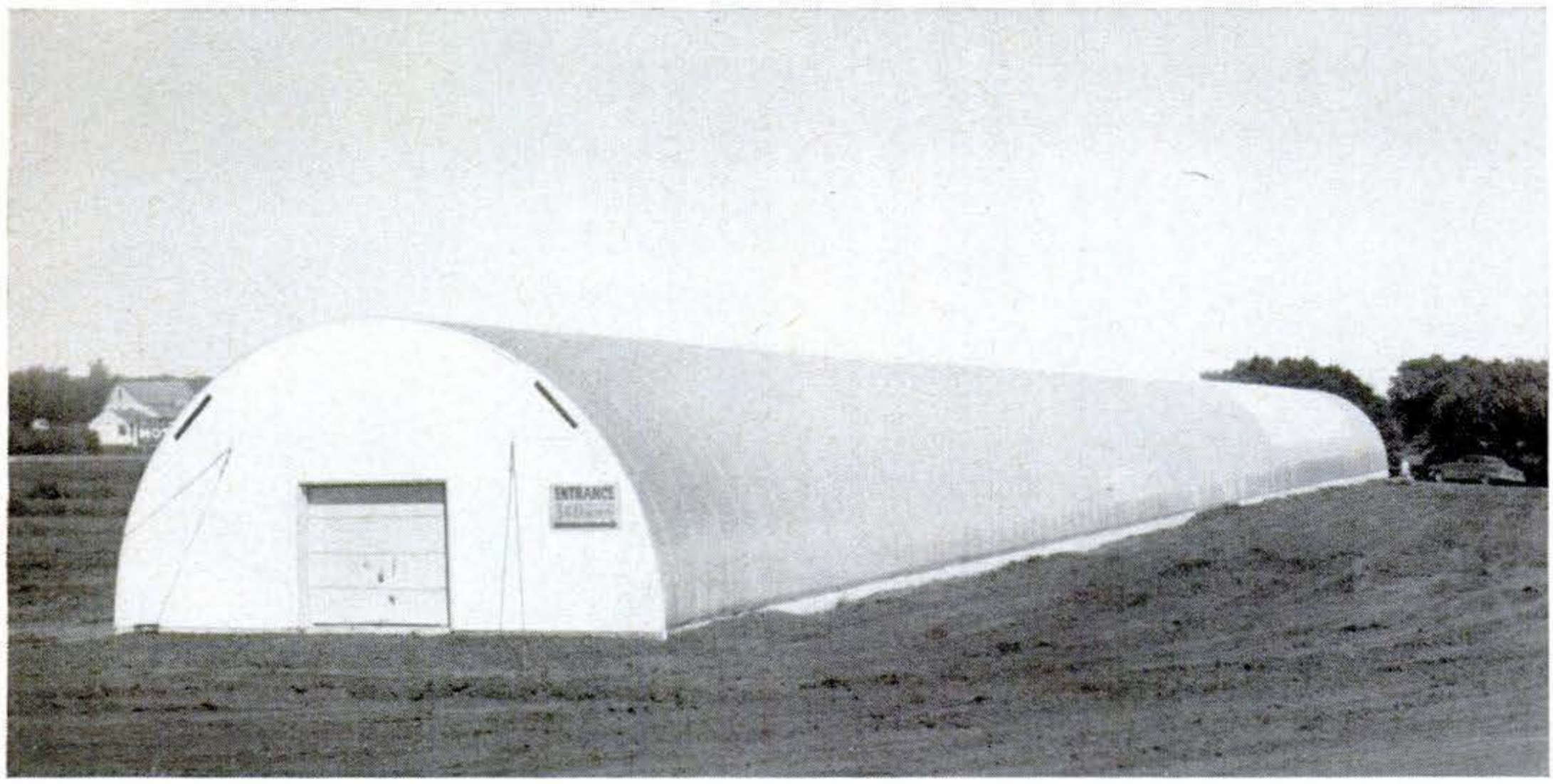




Boat runs on car power. An old differential mounted below deck and linked to the propeller shaft enables a Cleveland boat builder to drive this craft with his auto engine. The rear wheels are jacked up, and one



Blow-up factory for air-dome maker. When the G. T. Schjeldahl Co. needed room to expand making of plastic air-supported buildings, it built a factory of its own material in Northfield, Minn. The structure is 340 feet in length, 30 feet wide—longest blow-up yet.

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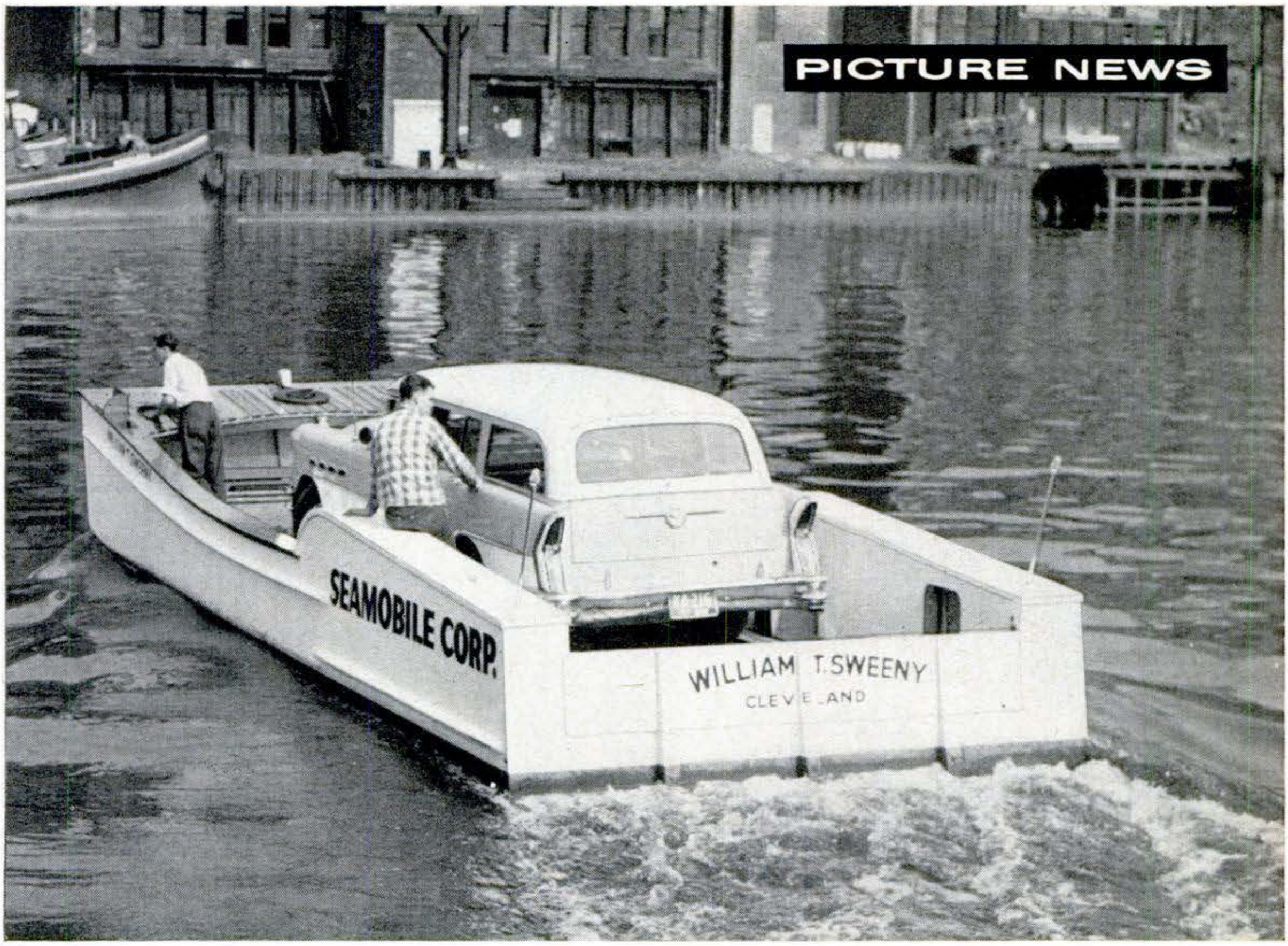
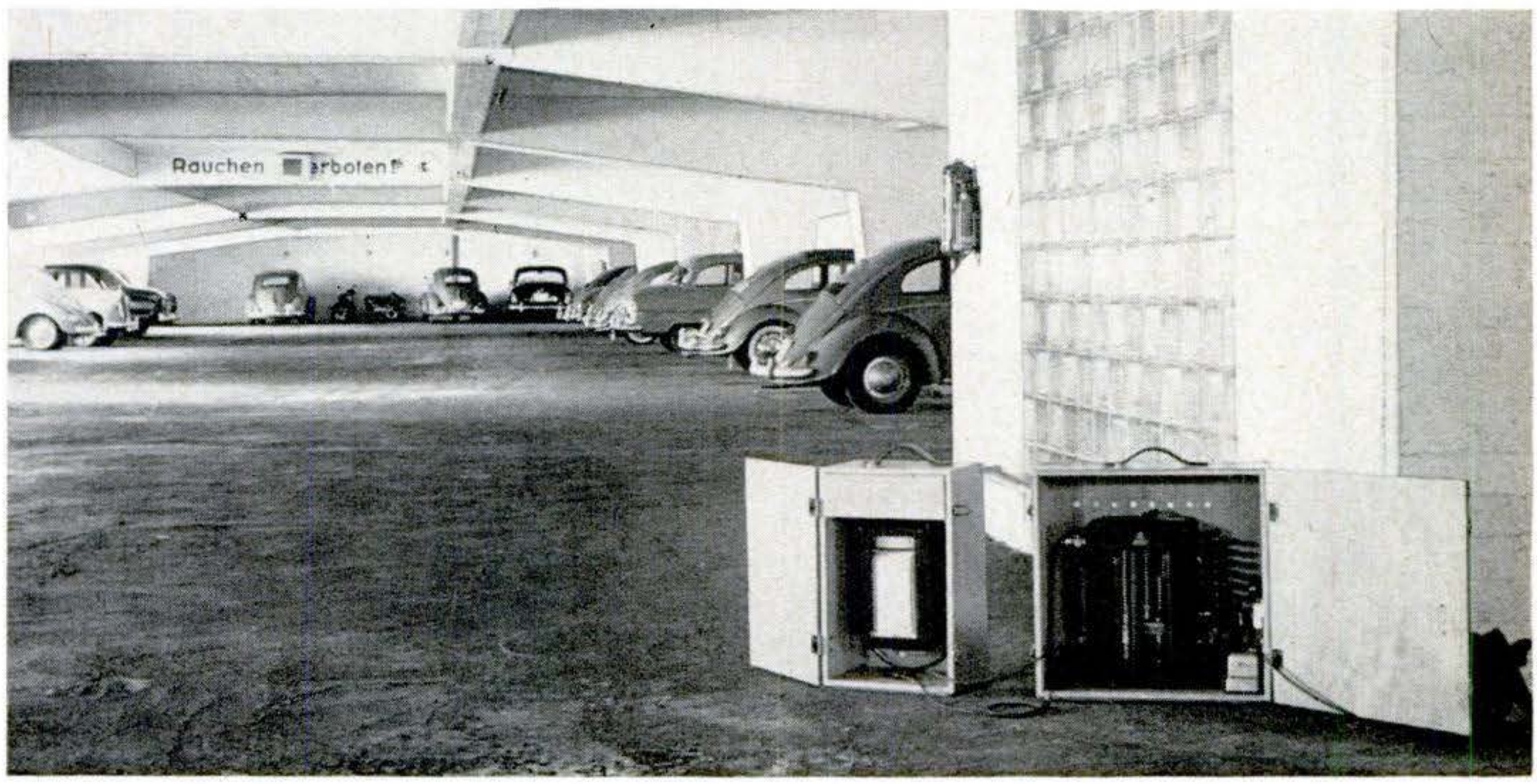


removed and replaced with a pulley as at left. Power is taken by belt through the differential to the propeller shaft. Top speed is 15 m.p.h., at which point the car's speedometer reads about 30.



Carbon monoxide meter. To keep the air fresh in an underground parking garage in Hamburg, Germany, the operators set up these instruments (foreground). The device at right measures carbon monoxide; the control starts the ventilators if gas nears the danger point.

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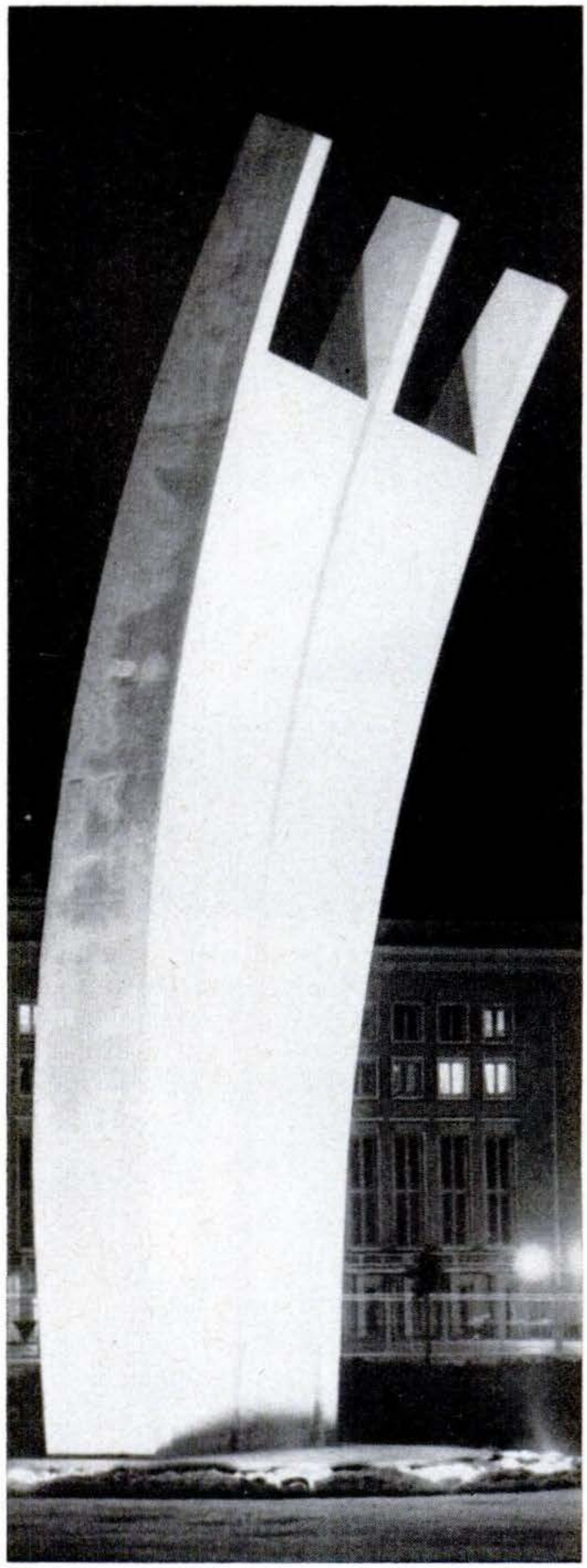
Goggle washer. Keeping mud-spattered goggles clean during a harness race is easy for sulky-driver Bobby Cherrix of Wilmington, Del. A hose attached to the rim floods them when he squeezes a hand-held valve that releases water from a bag strapped to his back.



Airlift memorial. This towering shaft symbolizing the end of a rainbow was erected as an arch of triumph in West Berlin. It commemorates the 1948-49 airlift during which the U. S. Air Force supplied the Communist-be'eaguered city with tons of food and fuel.

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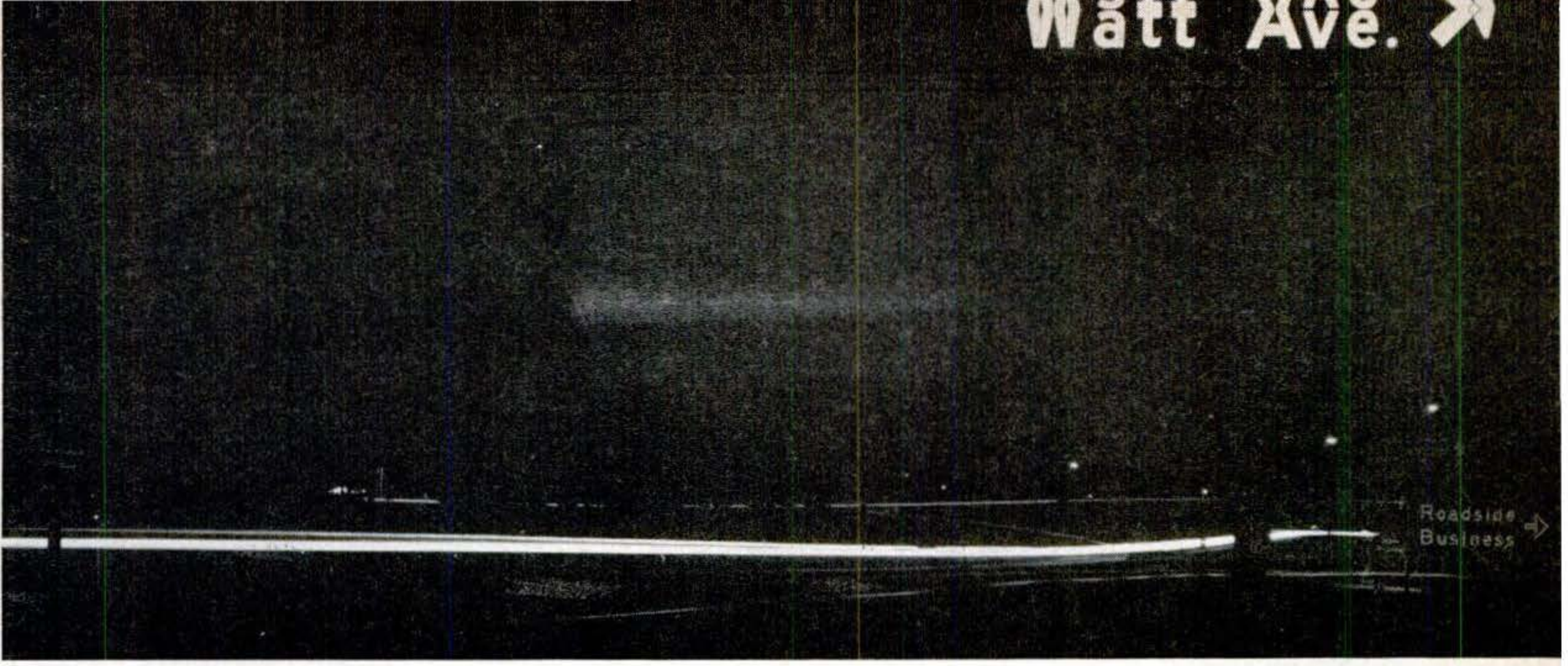

Ghostly marker. Eerily glowing, this highway sign, apparently floating in air, designates a turn-off on California's Sacramento-Roseville Freeway. It's an adaptation of Sylvania's electroluminescent light: a sheet-steel conductor covered by enamel and a layer of phosphor-holding ceramic.

Lifeboat on trailer. The inflatable rescue craft above aids airmen swiftly when a plane ditches in the Mersey at Liverpool's riverside Speke airport. It rides a trailer into the water, floats free, travels to the scene at 24 knots powered by an outboard mounted on its wooden transom.

Typewriter for scientists. This special British typewriter uses two synchronized keyboards, one with standard characters, the other with scientific and mathematical symbols. When the carriage is moved to the keyboard at right, the symbol pressed will fall into place in the text.

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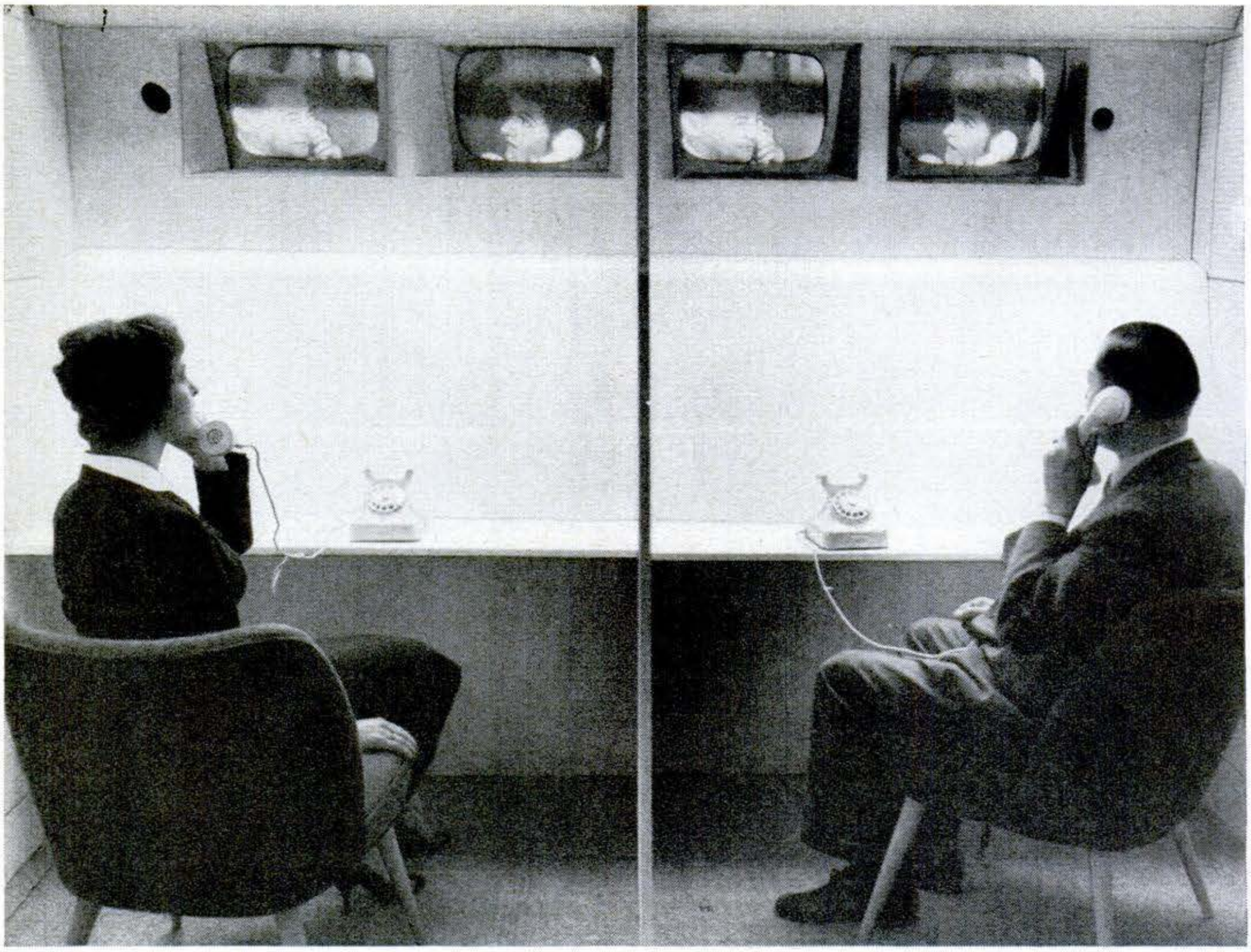

Double-look telephone. You can see how you look to the person you are calling on this new German sight telephone shown at the West Berlin Industrial Fair. These booths house a TV camera and two screens—one carrying your picture, the other a view of your party.

Music on wheels. This trailer, operated by two enterprising Cincinnati music teachers, is parked for certain hours at various suburban shopping centers. While mother buys groceries, junior takes an accordion or guitar lesson. The trailer has two classrooms, with an office between.

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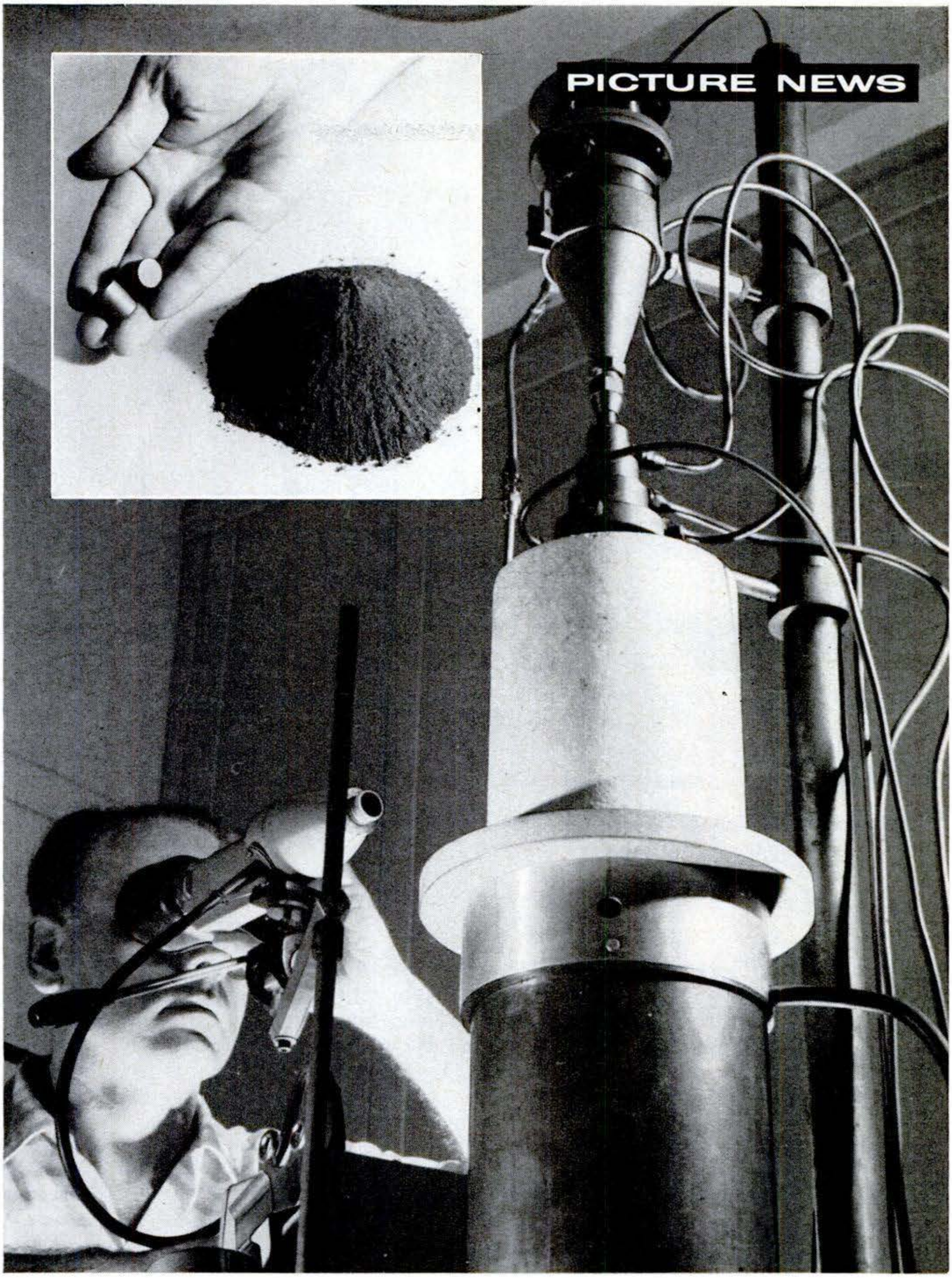

Heat into electricity. Three oxides, nickel, manganese and lithium-cobalt, are heated together in this furnace to make electricity—simply, silently, without moving parts. All are ceramics like those in clay or bricks. Westinghouse uses them in pellets or powder (inset), heats them to 2,000 degrees or more, chases electrons from one to another and in so doing produces current. Known as thermoelectric compounds, they are plentiful, light in weight, would pack easily into a satellite radio.

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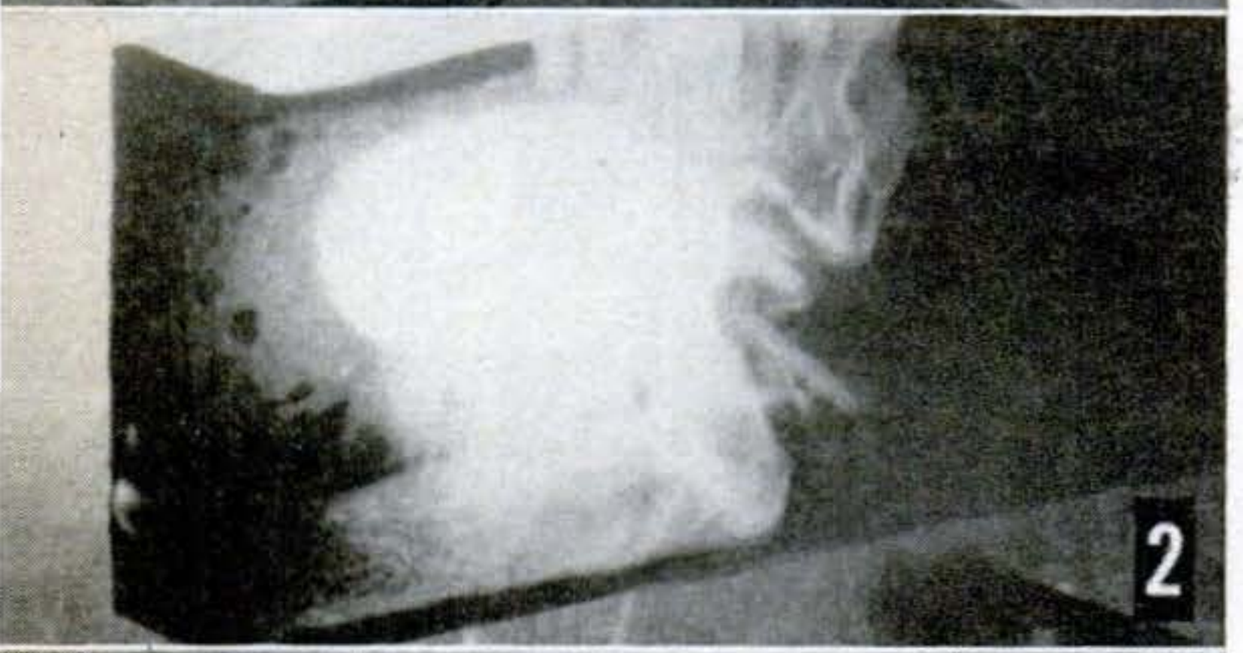
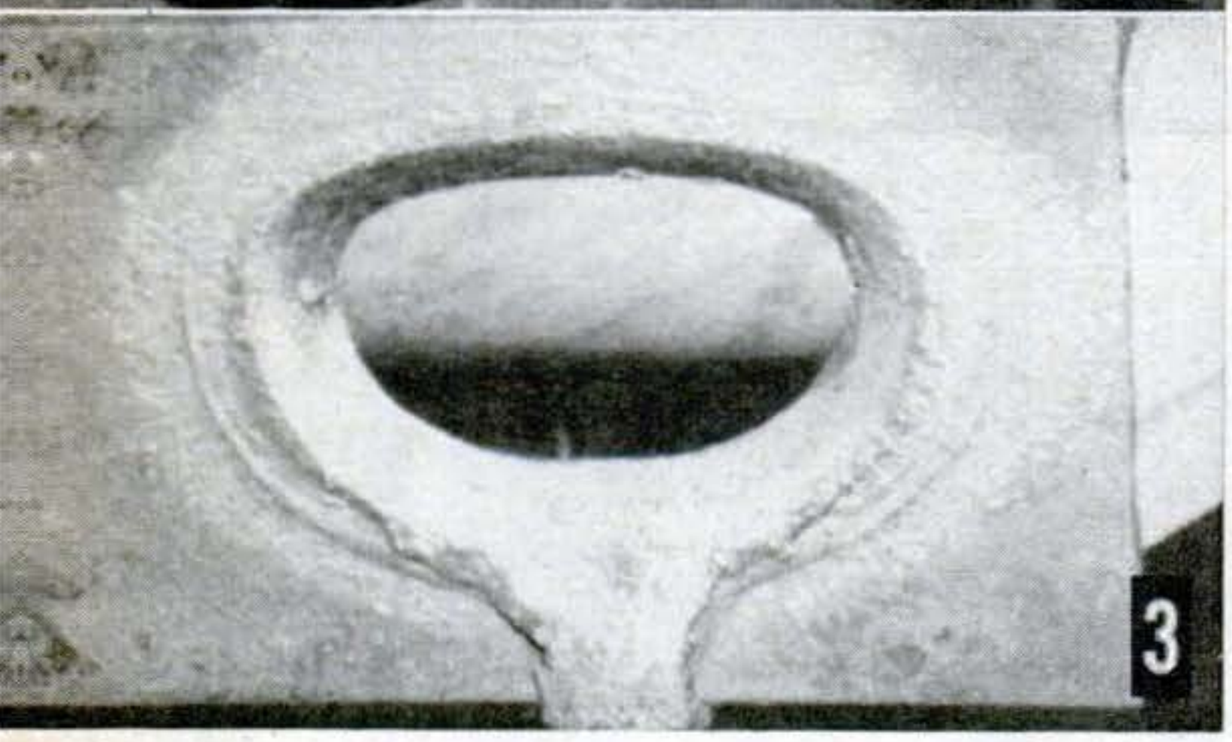
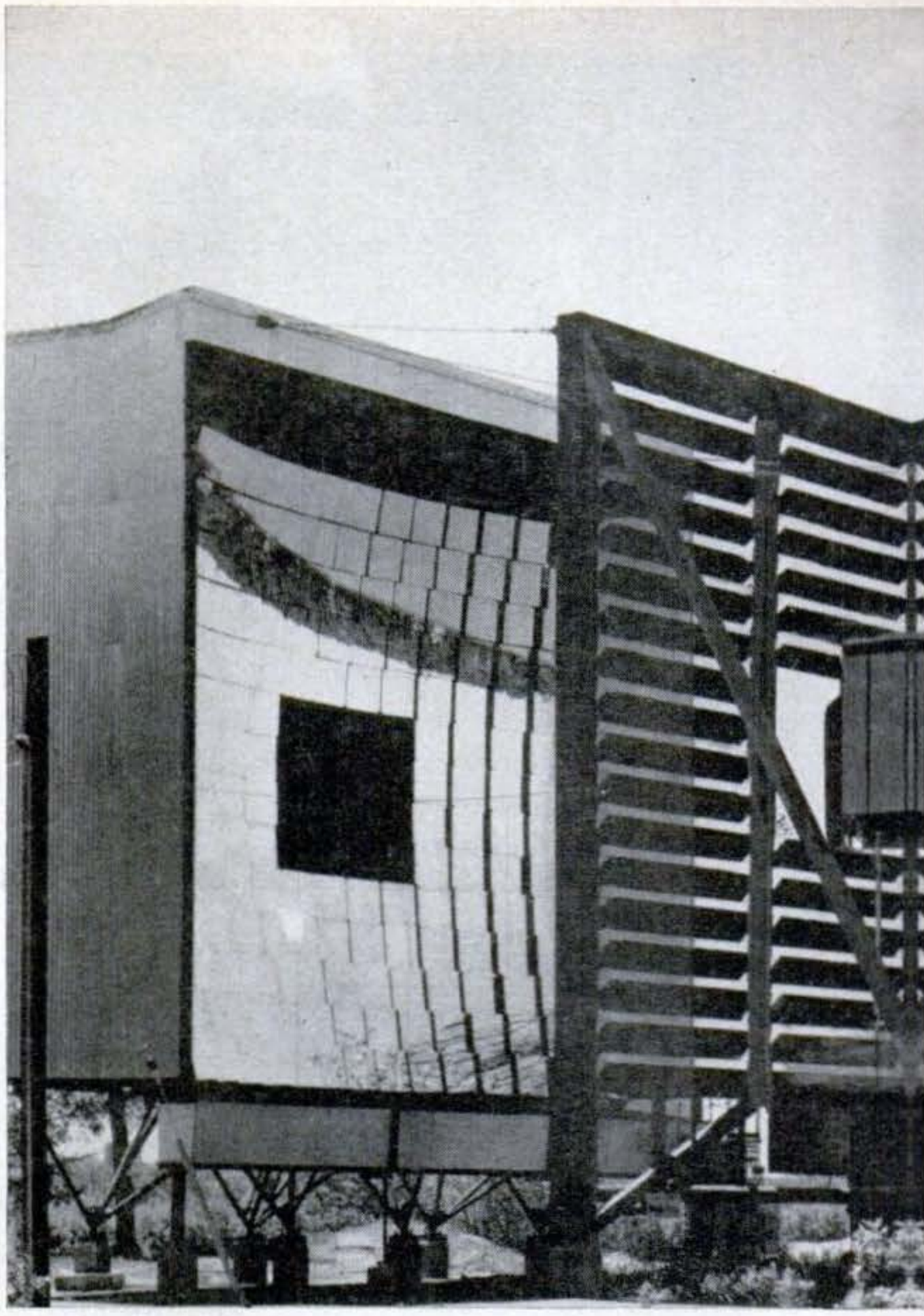
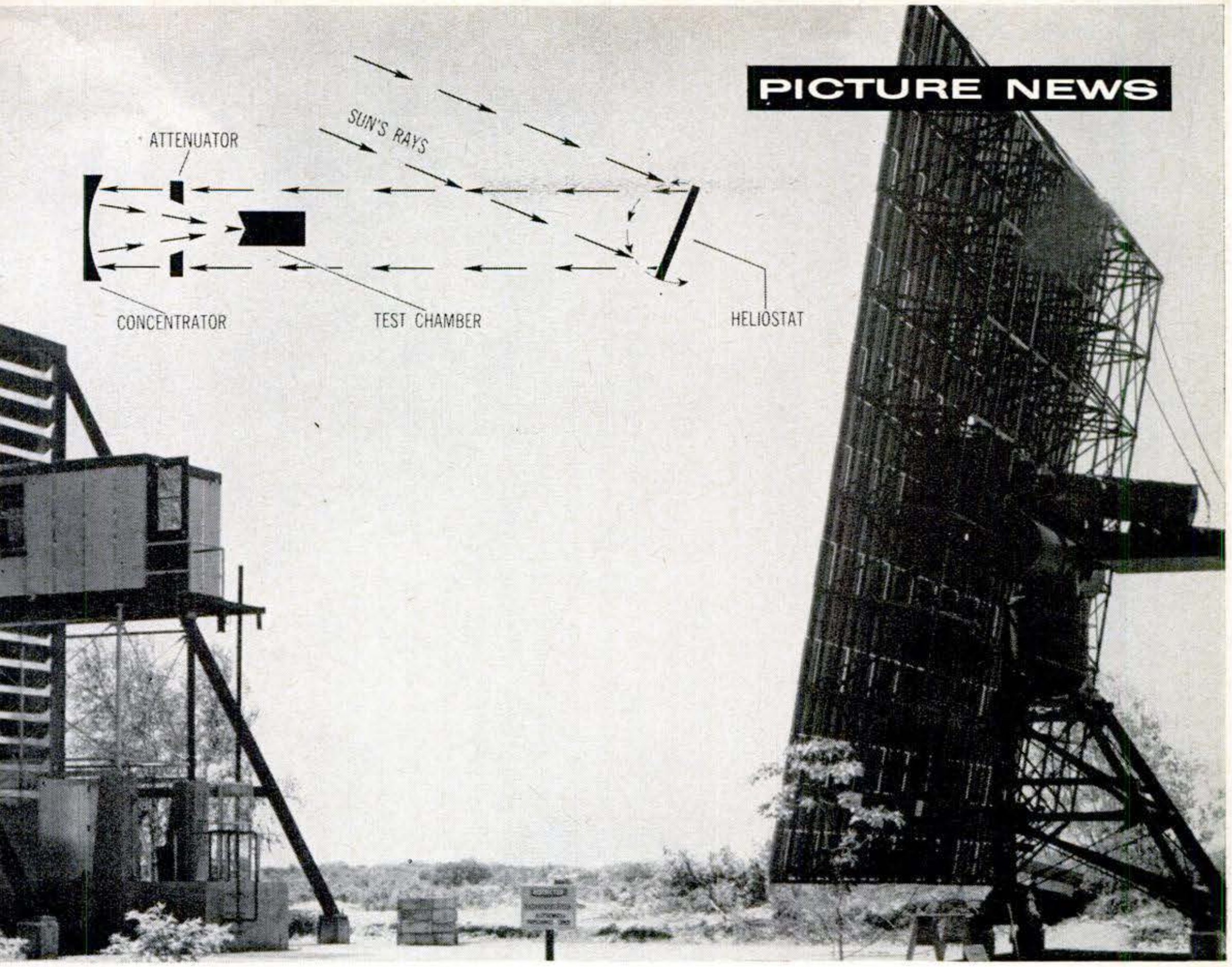






"Nuclear" solar furnace. Rays from the sun are concentrated to 5,000 degrees—hot enough to burn through the I beam in the sequence at left —in this big new solar furnace at Natick, Mass. It was built by the Army Quartermaster Research and Engineering Command to test ma-

Grip strip. Here is a nonmetallic fastener with no mechanical parts. It is simply two strips of nylon, one woven with thousands of tiny protruding hooks, the other with loops. Pressed together, they catch like a burr to clothing, can't be parted except by peeling. American Velcro, Manchester, N. H., makes them to hold anything from pants to upholstery.



terials that protect against heat from an H-bomb blast. Its 40-foot heliostat (far right) tracks the sun with 355 mirrors, reflects its rays through a "Venetian-blind" attenuator (adjustable to control heat) onto a 180-mirror concentrator that focuses them in a furnace in the test chamber.

Baby-size record player. This little British record player—said to be the smallest you can buy—has no turntable. Instead, its flashlight-battery-driven spindle turns records up to 12 inches on two powered rubber wheels so spaced on a common shaft that they spin small records at 45 r.p.m., larger ones at 33⅓ r.p.m. It sells for about $40.

Science probes mother love. Love—it's wonderful, say psychologists at the University of Wisconsin Primate Laboratory. But, they find, this baby monkey shows as much or more affection for a wooden dummy covered with terry cloth and warmed by a light bulb as for a real mother. The dummy is more patient, doesn't bite, scratch or scold.

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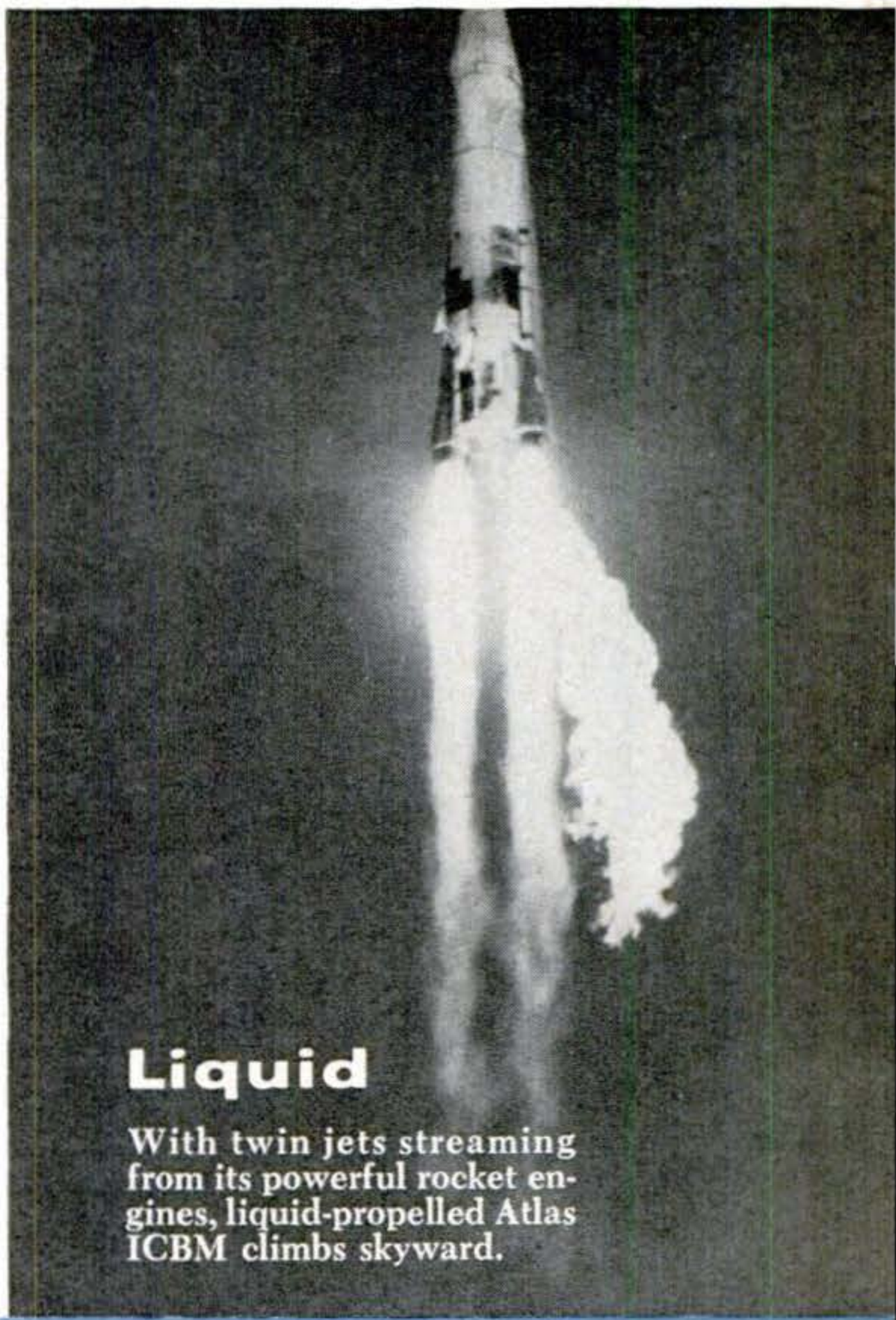
Battle of the Missile Fuels

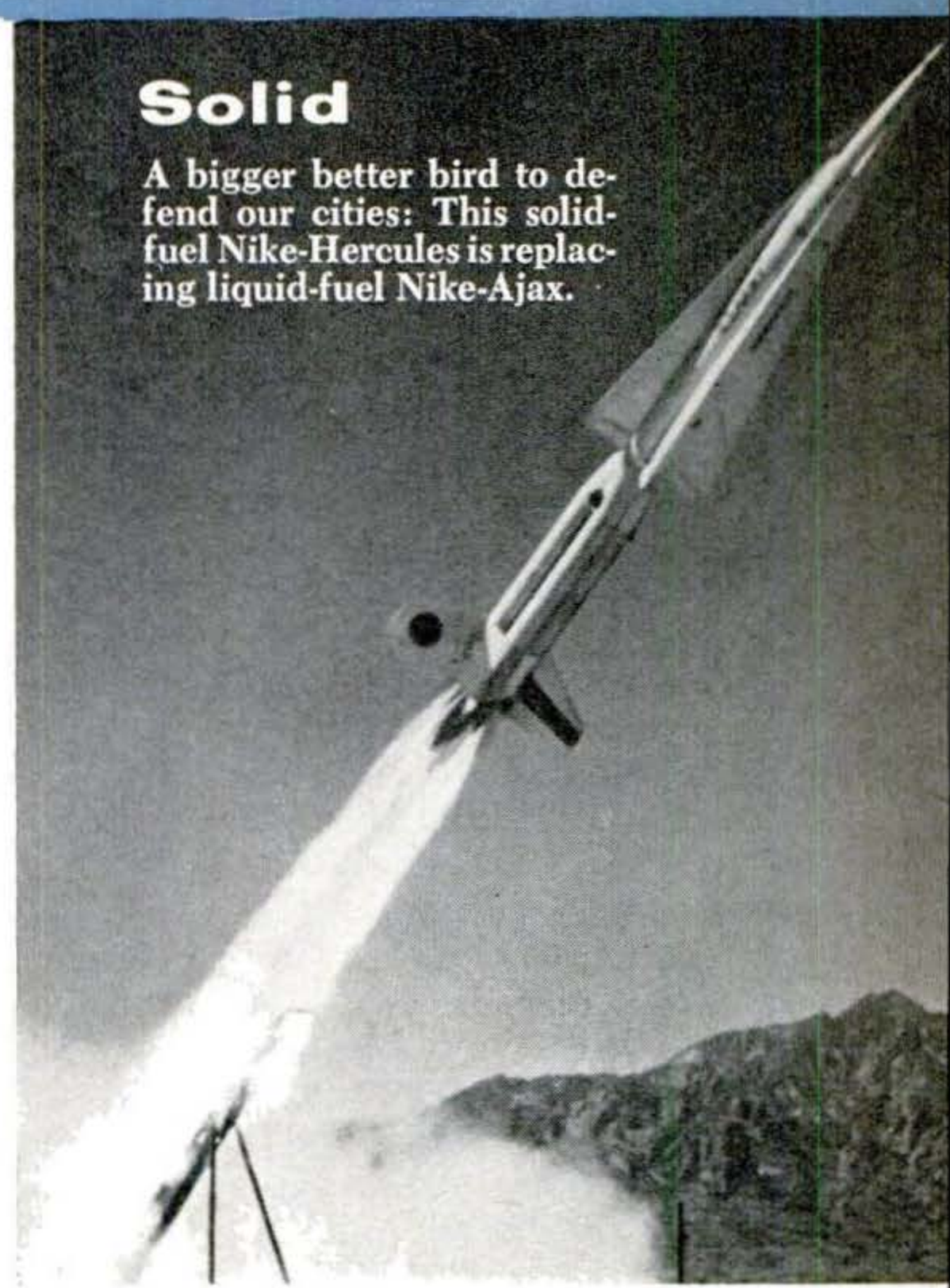
First the liquids, then the solids are ahead in an intense contest to provide the U. S. with simple, reliable, accurate "birds" for defense

By Wesley S. Griswold



Liquid

With twin jets streaming from its powerful rocket engines, liquid-propelled Atlas ICBM climbs skyward.



Solid

A bigger better bird to defend our cities: This solid-fuel Nike-Hercules is replacing liquid-fuel Nike-Ajax.

WITH the smug air of a man adept at parlor magic, a chemist in a missile plant stood before a roomful of fellow scientists and struck a kitchen match.

"That," he said, as fire flared instantly, "is a solid fuel."

He blew out the flame, dropped the burnt match into an ashtray, extracted a cigarette lighter from one of his pockets and flicked—and flicked—and flicked—

"This," he said, as his audience broke into laughter, "is a liquid fuel."

It was a trick—and a dirty trick at that, for he hadn't filled the lighter—but it dramatized a vital defense fact: Solid-fuel missiles *are* simpler and more dependable than liquid-fuel missiles.

That is the basic reason why the U. S., at the same time that it is striving to perfect its first-born brood of liquid-propelled missiles, is trying strenuously to hatch solid-fuel "birds" for every pertinent military purpose.

Already there is a flock of them on the

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"Filling the tank" of a solid-fuel rocket engine

METAL CORE IS LOWERED into empty engine case (near right), and fuel mixture is poured in (center photo). After fuel is cured, core is removed. Far right: typical cross section of solid-fuel rocket engine. The more intricate the fuel's configuration, the larger the burning surface—and the greater the thrust.

wing for air-to-air missions: Sparrow, Falcon, Zuni, Sidewinder, Genie.

Dart is available to attack tanks, and Rat to swoop upon submarines. Little John, Lacrosse and Honest John are remarkably accurate, highly mobile missiles for 10-to-20-mile ground fire. Sergeant will soon be ranking liquid-fuel Corporal out of very-long-range artillery assignments.

Nike-Hercules, a bigger, better bird than liquid-fuel Nike-Ajax, is beginning to supplant that earlier antiaircraft missile in the defensive rings around our cities.

On the way are Hawk, a deadly threat to low-flying planes; Bull Pup, for heavy, short-range, air-to-ground blows; and the Navy's extraordinary Asroc and Subroc, missiles with nuclear warheads that will flash through both water and air.

The armed forces wish that every weapon were as ever-ready as a rifle. So they naturally favor solid-fuel missiles, many of which are—in propulsion—not very much more complicated than an old-fashioned skyrocket.

But it was thought until quite recently that solid propellants could never be used to hurl thermonuclear warheads many hundreds or thousands of miles. Rocket scientists didn't believe that solid-fuel missiles could be made powerful enough, or their rate and duration of burning sufficiently precise, or their steering accurate enough, for them to supplant the liquid-fuel IRBMs (Thor and Jupiter) and ICBMs (Atlas and Titan). High-pressure research is proving those scientists to be wrong.

As this is written, a full-scale model of the remarkable Polaris [PS, May], first IRBM to be propelled by a solid fuel, is undergoing test firings at Cape Canaveral. In fact, such promising (though secret) discoveries have been made in developing Polaris that the Air Force has plunged ahead with plans for an even more astonishing weapon: Minuteman. This will be a three-stage solid-fuel missile, to be fired from concrete-walled chambers sunk 80 feet in the ground. Its third stage, used alone, can be a tactical missile with a range of 500-1,500 miles. Teamed up, Minuteman's second and third stages will form an IRBM of 1,500-mile range. The full-size, three-stage bird will be able to fly more than 5,000 miles, rivaling Atlas and Titan and having the incalculable advantage over them of being in constant readiness, able to be fired at command.

Does this wholesale invasion of the missile field by solid propellants mean that liquid fuels will soon be abandoned forever? Not at all. There are stubborn problems that plague the solid-fuel experts. In some ways, liquid fuels, despite exasperating drawbacks, are still ahead.

What are the present advantages and disadvantages of the two types of fuels? From experts at Aerojet-General Corp., which has been called the "General Motors of U. S. rocketry" and is in the unique position of working full tilt with both liquid and solid fuels, come most of

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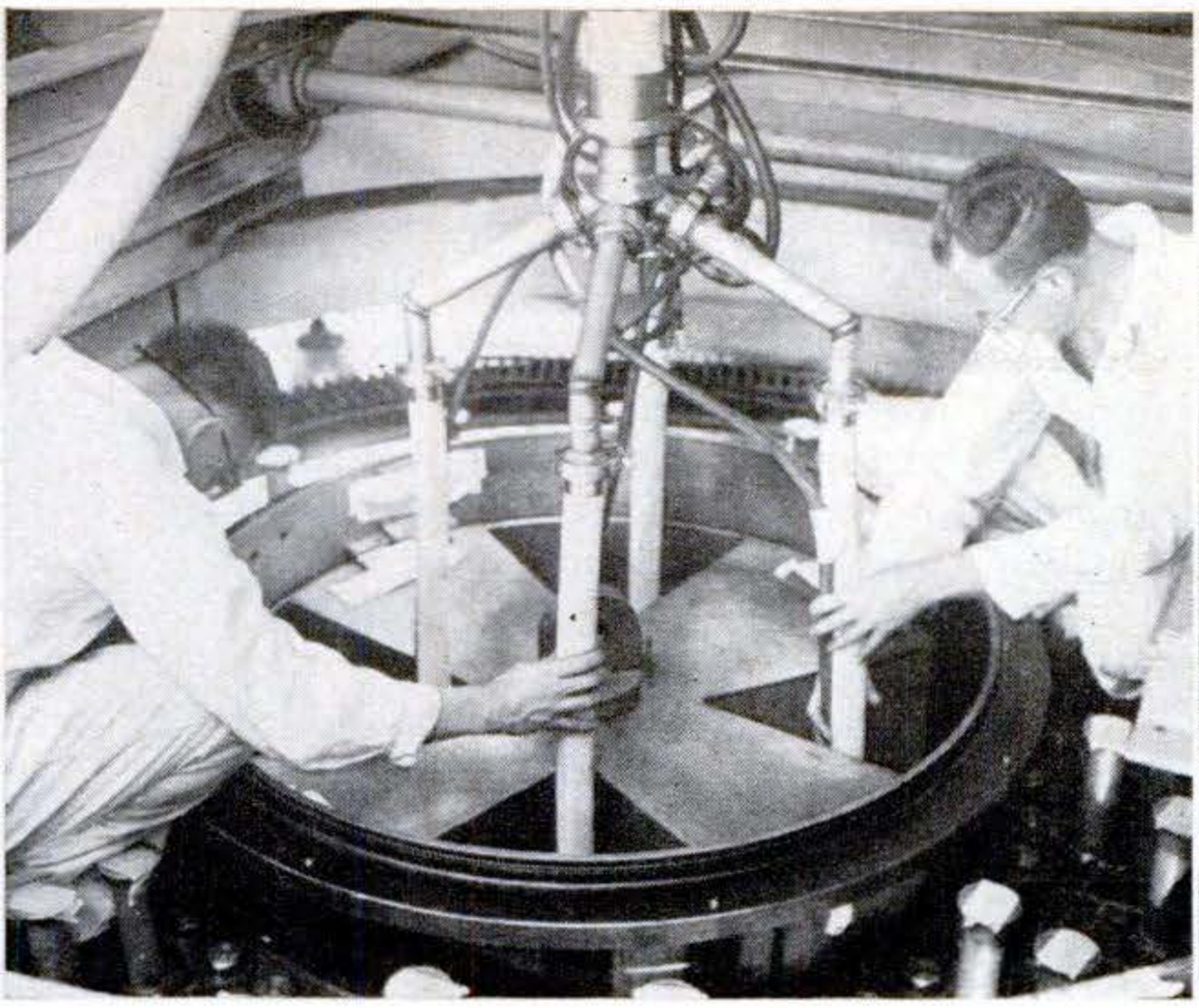

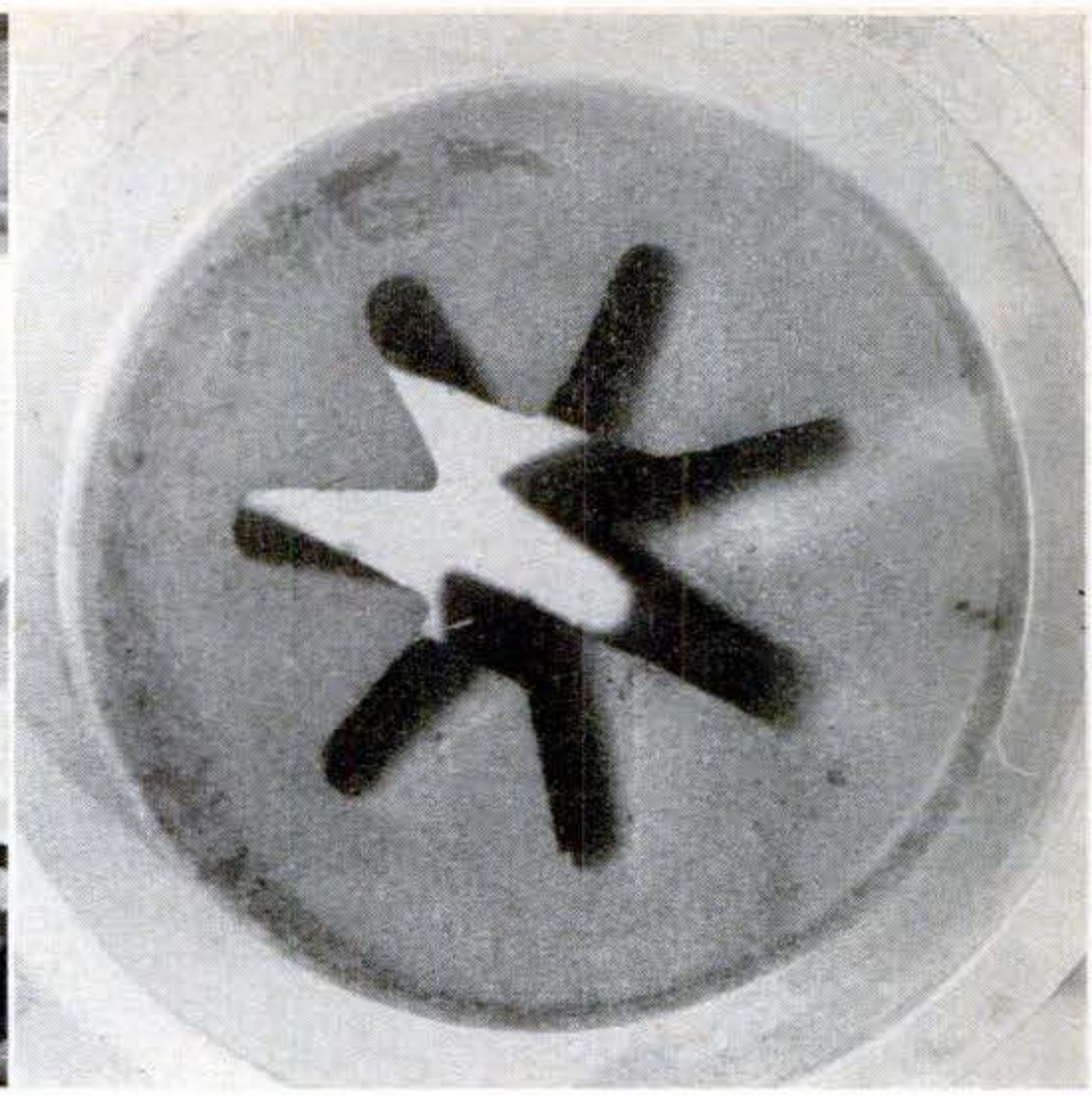

the answers and arguments listed below.

In favor of solid fuels:

- They are denser than liquids, and so can be packed in smaller spaces.
- Their oxidizers, which enable them to burn, are built in—and stable.
- The missile case is both fuel container and combustion chamber. It has no moving parts, and thus is highly reliable.
- Solid-fuel missiles can be easily moved (if they are not too big), handled with little danger, stored for long periods and launched in a jiffy by relatively unskilled crews. They don't need to be serviced in the field. They don't require long countdowns before blasting off.
- They can be produced more quickly and cheaply than liquid fuels.

Against solid fuels:

- Even though they are denser than liquid fuels, they haven't yet developed as much energy (specific impulse).
- They weigh more than liquid fuels of comparable performance.
- They may burn erratically in frigid, scorching or very humid atmosphere. If the temperature is well below zero or high above 100 degrees, the "grain"—the shape in which the fuel has been cast—is liable to crack. This exposes new surfaces to combustion and plays hob with the engine's thrust, ruining accuracy.
- A big, high-performance solid-fuel motor can burn only about a minute without overheating, and destroying, the missile case. Therefore, to gain the greater ranges that Polaris and especially Minuteman require, extra motors are needed. This means that the missiles must have additional stages, and thus become more complex, less dependable.
- They can't be throttled, or shut off and reignited. It is possible to mix and cast a single grain that will burn at specific, varying rates, but then those rates are fixed. They cannot be altered later. Once a solid propellant starts to burn, it has to keep on burning until the fuel is gone. This puts it out of the running for powering manned flight.
- Solid-fuel missiles are difficult to steer. Since the combustion chamber is the missile case itself, the fierce rush of gases that hurls the missile forward must be angled by movable vanes in the throat of the missile nozzle, or by gimbaling the entire nozzle. Neither solution is wholly satisfactory.
- It is formidably hard to cast grains big enough (five to eight feet in diameter) to provide thrust comparable to that of liquid-fuel IRBM and ICBM engines.

In favor of liquid fuels:

- They burn with greater fury, provide higher thrust and can burn for a longer time without risk of overheating the combustion chamber, which is separated from the fuel tanks and cooled by fuel circulating through its walls. These assets combine to give tremendous range to big liquid-fuel missiles.
- They can be throttled, or turned on and off again. They can be made to leave the ground at a far slower rate of acceleration than solid-fuel missiles. These factors together make liquid-fuel missiles

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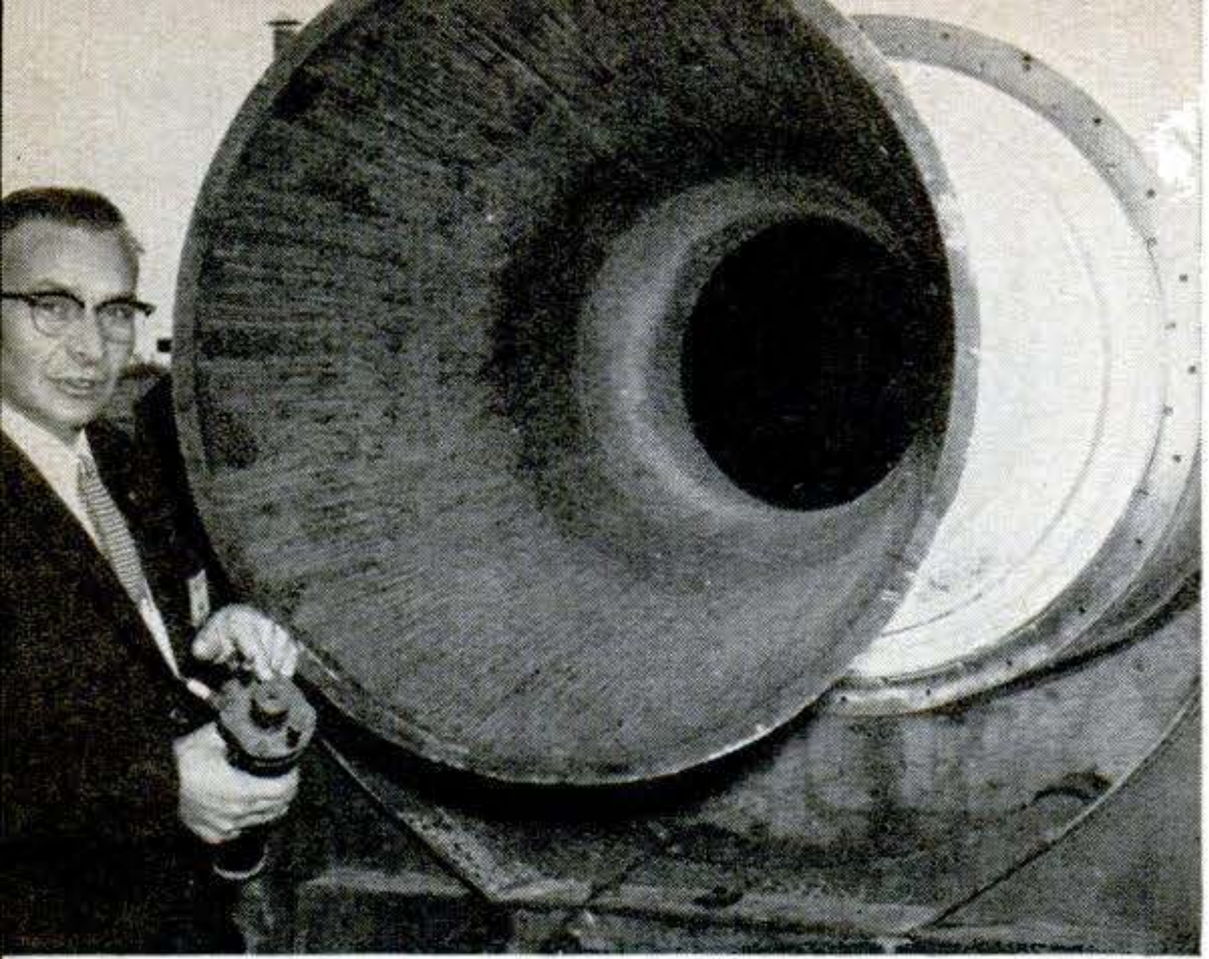

HUGE SOLID-FUEL MISSILE ENGINE, 30 feet long with a three-foot nozzle, makes a striking contrast with little hand-held rocket motor—one of first built for jet-assisted takeoff.

the only ones feasible for taking man into space.

- They operate efficiently at any temperature they are likely to encounter.
- A liquid-fuel missile is somewhat easier to control in flight, for its entire thrust chamber (not just the nozzle) can be gimbaled. Furthermore, exhaust from the missile's gas turbine can be used to help keep the weapon on a steady course.

Against liquid fuels:

- For all long-range missions, a vehicle of bewildering complexity and extravagant size is necessary.
- A big liquid-fuel missile is a mass of tanks, valves, plumbing, pumps, gauges, circuitry, thermocouples, igniters, gears, generators—almost countless parts. One tiny blockage in that snarl of innards can make the mightiest missile useless.
- Checking out this complex monster takes hours of countdown time. It must be test-fired before it can be launched by a crew of highly trained specialists.
- The oxidizer, usually liquid oxygen (lox), must be taken aboard separately, at almost the last minute and by remote control. This is because it is erratic and dangerous. If it touches grease, it causes an explosion. If it comes in contact with certain fluids, it combines to form jelly so inactive it would take a dynamite cap to bring it to life. To remain liquid until it enters a missile's combustion chamber, lox must be kept refrigerated to nearly 300 degrees below zero. At this temperature, it threatens to make brittle any flexible material it touches. Engineers have licked this problem for contacts of short duration, such as the period just before and during a missile's flight. But lox could not be allowed to stay inside a missile very long or it would seriously deteriorate flexible plumbing. Result: No liquid-propelled missile using lox as an oxidizer can be in pushbutton readiness.
- If the missile is too complicated to use turbopumps to feed fuel into the combustion chamber, fuel tanks must be pressurized. This process is another impediment to quick launchings.

Solid- and liquid-fuel specialists are racing to overcome the disadvantages.

What are the prospects? Experts see these things for the liquid-fuel team:

Far simpler pumps and more efficient thrust chambers are on the way. "We are on a simplification binge," reports a leading Aerojet research engineer.

There will be storable propellants of higher specific impulse and greater density, using nonvolatile oxidizers. Security restrictions muzzle specific talk about these. A Rocketdyne scientist made a tantalizing comment, however. "You could build a storable liquid-fuel missile system with no more moving parts than a comparable solid-fuel missile system," he said. "It would be lighter than the solid-fuel job, too, and just as fast to fire."

Bigger payloads will result from better oxidizers. Using liquid fluorine as an oxidizer, Bell Aircraft has developed a fuel which, they say, increases the potential power of rocket engines 22 to 40 percent and can lead to a 70-percent payload increase. (Some engineers believe a fluorine engine put Russia's 1½-ton Sputnik into orbit.)

What's in store for the solid-fuel team?

Grains will get metal additives, which provide higher energy than today's rubber and plastic fuels.

The burning rates of the grains will be fixed with even greater precision than has been achieved with Polaris.

Outside temperature will have less effect on the grains.

The solid-fuel men are thinking, too, of making it possible for solid-fuel missile squadrons to mix and cast their own grains in the field. Also, missile cases will become lighter. Perhaps they'll even be burnable, thus disappearing with the last spurt of flame and permitting the warhead to plunge on unimpeded. END

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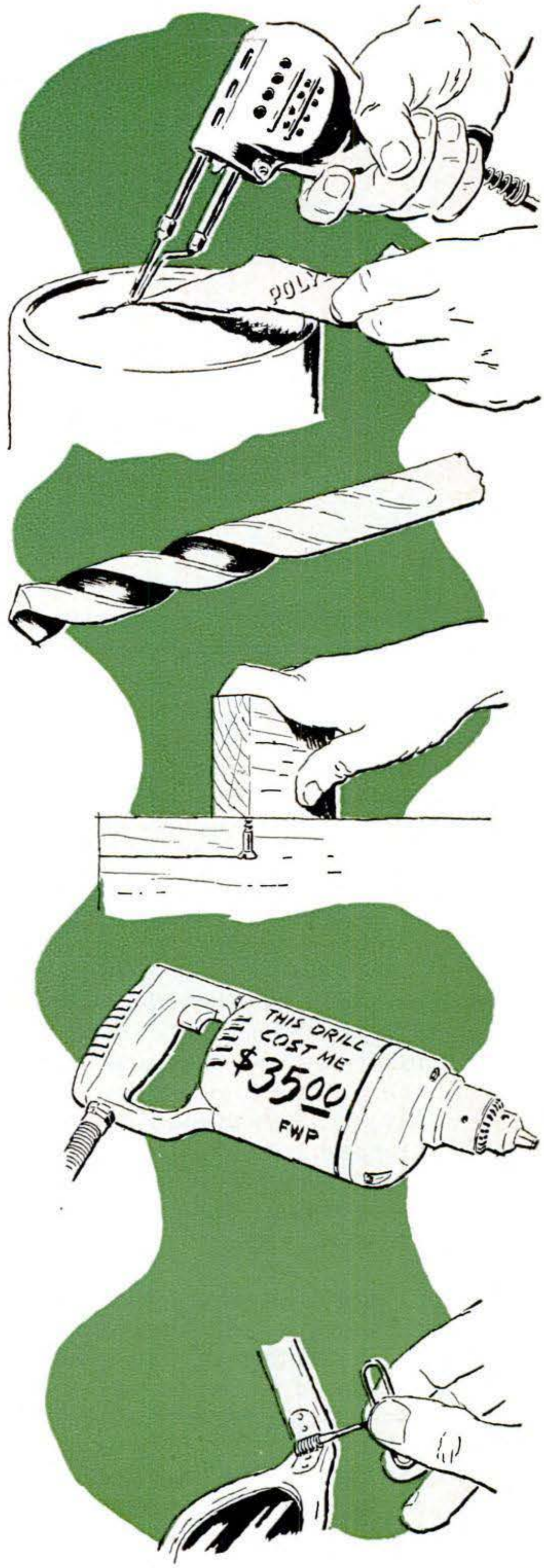
5 BUDGET SAVERS for Home Owners

1 You can "weld" soft plastic. If a polyethylene dishpan or scrub pail cracks at the bottom, cut a scrap from a discarded poly utensil. Using a soldering gun, soften the edges of the break and fill in with the scrap. When cool, the mended utensil will be as strong as ever.



2 A broken twist drill can be salvaged —don't throw it away because it won't run true in a chuck. Just fill the flutes with solder for a distance of about ¾″ from the broken end, then file down any unevenness in the soldered area. Now you can seat the drill solidly in the chuck for accurate and trouble-free use.

3 Need a marking gauge? To make one that costs nothing, drive a wood screw an appropriate distance into a block of wood. Press lightly when using the gauge and always check the "setting" on scrap before using it on the work piece.

4 Money talks. Let it speak up for you to remind a lax neighbor to return a borrowed tool: With bright red paint, mark the cost on each piece of equipment. There's nothing as impressive as the dollar sign, and borrowers will not only return an electric drill or an ignition-timing light promptly, but may be "talked" into using the tool with more care.

5 Tightening tiny screws in eyeglasses is easy with the right tool. To make a midget screwdriver, bend out one end of a paper clip. Hammer the end flat, then shape the tip with a fine-cut file.

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6 Ways to Sharpen Your Memory

By Max Gunther

YOU probably know a man with a good memory—and envy him. He remembers names, faces, appointments—and the boss's instructions. He makes good use of after-hours studying for advancement, for he easily stores lessons and magazine articles in his head. He's known around the shop or office. "Ask Joe," they say. "He'll remember." That kind of man has a decided edge in the fight for success.

You can be Joe, the guy who's ready with the right answer. For decades of testing have shown psychologists a good deal about how memory acts (although they still aren't sure how it is engineered). They can tell you how to remember things most quickly, recall them most precisely, hold them longest.

Surprisingly, few people know these things. By learning what researchers know, you'll be one up on rivals for big jobs ahead.

It's not hard to learn, either. The School of Memory and Concentration, which holds classes in many cities, offers a standard course of 10 two-hour sessions. At graduation, students show off by remembering the order of 52 playing cards after looking through the deck once.

There may be a memory-training course offered near you—in a privately run school, or in a college or an adult-education program. If not, get hold of a book such as Brendan Byrne's *Three Weeks to a Better Memory* or Dr. Bruno Furst's *Stop Forgetting*. Or buy a home-study course. Before signing up with any school, however, check on it with your local Better Business Bureau or the National Home Study Council (1420 New York Avenue, Washington 5, D.C.).

All the books and courses rely on the same basic findings of psychologists.

Using both memory levels

There are two main levels of memory:

- Your *conscious* memory contains items that you call up at will, such as your own name.
- Your *subconscious* memory contains a vastly bigger store: items temporarily forgotten, but which can be recalled if something reminds you of them.

To remember better, you have to use both levels of memory:

Deliberately store important items in the conscious level, by understanding and using basic memory phenomena.

Let other items sink to the lower level, but hook them to "reminders"—more easily recalled kinds of data that won't sink.

The exact way in which you use your memory depends on the situation, the kind of material you're dealing with, and

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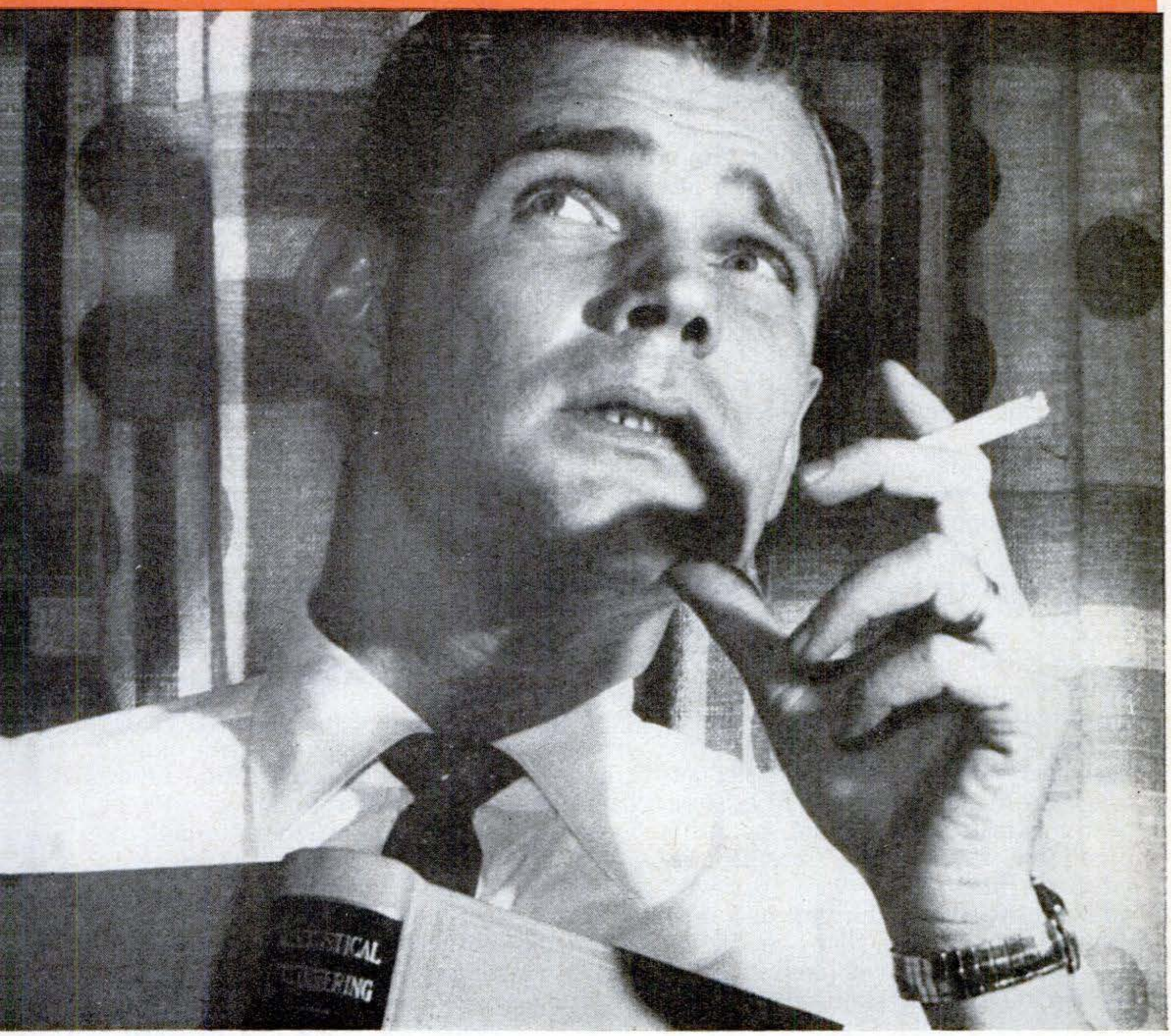
Just about the weakest excuse you can make is: I forgot.

But you don't have to make excuses. Knowledge of how the memory works will help you tighten up yours, even if it's now as leaky as a sieve . . . and when a promotion comes up for a sharp-minded guy, the boss will remember you



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your own preferences. Here's what experts teach about everyday memory tasks:

Remembering names

Says an executive of International Business Machines, which runs a memory course for employes: "Remember a man's name, and how many kids he has, and what his job is, and you flatter him. You make him receptive to you and to whatever you want him to do for you. Forget these things, which are important to him, and you have a strike against you —maybe three."

The best way to remember a name is to tell yourself—firmly—to do so. The memory is much like an electronic computer. It wants concrete instructions.

The late Prof. E. L. Thorndike experimented with this phenomenon at Columbia University. He told a group of students to copy a word list. He told a second group to copy and *memorize* the list, allowing the same length of time. The second group later remembered almost twice as many of the words as the first group.

So to remember a man's name and job, "set" your memory. Don't merely listen as he introduces himself. Deliberately instruct your brain: "I must remember that this tall, bald fellow with the long jaw is named Walter Phillips."

It also helps to pronounce the name aloud right away: "Walter Phillips? Pleased to meet you, Mr. Phillips." This gives your memory an extra "hook." Many people—and you may be among them—have a strong memory for their own lip and tongue movements.

Memorizing instructions

Your boss is walking down the corridor with you. "Joe," he says, "I want you to do a job for me." He then rattles off a complicated set of instructions. How do you make sure of remembering them?

Again, set your memory with a deliberate decision to store what you're hearing. Repeat the instructions aloud, counting them off on your fingers. *Carefully remember the number*. If there are seven, for instance, and you later remember only six, you'll know you've lost one. If you don't count, you're just as likely to think six is the total. A week later, the boss taps you on the shoulder again. "Say, Joe, things are kind of fouled up over here. You forgot to . . ."

If you need to remember the instructions for several days or more, review them to yourself often during the first day. Psychologists discovered that you forget fastest during the first hour, more slowly afterwards. Typically, you might forget 25 percent during the first hour, 25 percent more during the next six hours for a total of 50 percent, 25 percent more in the next two days for a total of 75 percent.

Thus, by going over the instructions often during the first day, you'll brake your forgetting. Each time you review, the rate of forgetting slows up.

If you have to remember long sets of instructions every day, try the "link" method, a trick taught by almost all memory experts. Entertainer Harry Lorayne, author of *How to Develop a Super-Power Memory*, uses it for such staggering feats as remembering 100 items called out at random by an audience.

Suppose, for example, that you're asked to work on a car: (1) change oil, (2) repair windshield wiper, (3) rotate tires. Here's how Lorayne suggests you remember the list:

First, think of some bizarre, nightmarish association between items 1 and 2. You might imagine opening an oil can and finding it full of windshield wipers. Then do the same for items 2 and 3, perhaps visualizing installing tires where the windshield wipers should be. Go on to link 3 and 4 in the same way, and so on.

Some people can remember even a 25-item list this way—with no practice. Each item is hauled out of subconscious memory by the bizarre, *memorable* association with the item that went before it.

Your mental alarm clock

Another kind of memory you need is the "alarm clock" memory—the kind that wakes you up at some future hour and day to tell you that you have a PTA meeting to attend, or a letter to mail.

Dr. Bruno Furst, who directs the School of Memory and Concentration, suggests another linking gimmick, one that lies dormant—just like an alarm clock—until the time comes for it to ring a bell.

Suppose your boss tells you, "Joe, they're scraping the floors this weekend.

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How Good Is Your Memory?

THE three lists of numbers below not only test how retentive your memory is now, but show the easiest way for you to improve it.

Some people remember best what they hear, others what they see, while still others recall their own body movements. Use these lists – one for sight, one for sound, one for movement—to find which method gives you the highest memory score. Then concentrate on that method for improving your memory.

Start with sight. Without moving your lips, read the top number. Allow about one second per digit. Then look away and write the number down. Continue through the list as far as you can.

Your score is the largest number of digits you can recall perfectly. (The average college student remembers seven- or eight-digit numbers; 12 digits is exceptional; four or less, weak.)

To test your movement memory, do the same thing with the middle list, this time moving your lips silently as you read. For sound memory, have someone else read the right-hand list to you digit by digit.

SIGHT	MOVEMENT	SOUND
5239	1307	9614
60723	93968	50863
832629	613904	142058
1472930	2903748	9735521
30263084	13740261	03825706
792511361	801645273	135840318
9023485279	9138520361	1068362047
61308472614	06374188352	64729364951
259371048328	973617148639	580163270462

So before you leave Friday night, stack all that equipment on a bench." To set your alarm clock, think of something that you're *sure* to do just before you leave that night. Maybe you shut off a set of valves. In that case, imagine some nightmarish link between shutting off valves and stacking equipment on a bench. Once the link is established in your mind, you'll remember the stacking chore the minute you reach for the valve handles.

If there's nothing special about Friday night in your schedule, set up your link with something you do every night. Maybe you change clothes. By imagining some ridiculous or shocking association between clothes-changing and equipment-stacking, you'll remember the special chore every night—including Friday.

The important point is to pick out solid landmarks in your future schedule—things you're certain to do or see. If you want to remember to mail a letter, imagine the addressee standing on his head atop your corner mailbox, or on your car's hood. Your memory will ring a bell next time you see the mailbox or your car.

For far-off obligations, such as a meeting next month, Dr. Furst suggests that you deliberately set aside five or 10 minutes once a week to review your schedule. This way, you automatically—and repeatedly—give your memory the specific instructions it needs to store important dates. As each date draws close, you can rig up a link for it.

Cramming your memory

Sometimes you have to memorize a big mass of material. Maybe you have to take an exam to get a job or a license.

The noted 19th Century psychologist, Hermann Ebbinghaus, probed this kind of memory with results that are still used today. He found that you can remember a mass of material best if you spread the work over several days. When he tried to memorize a list of words in one day, he

[*Continued on page 226*]

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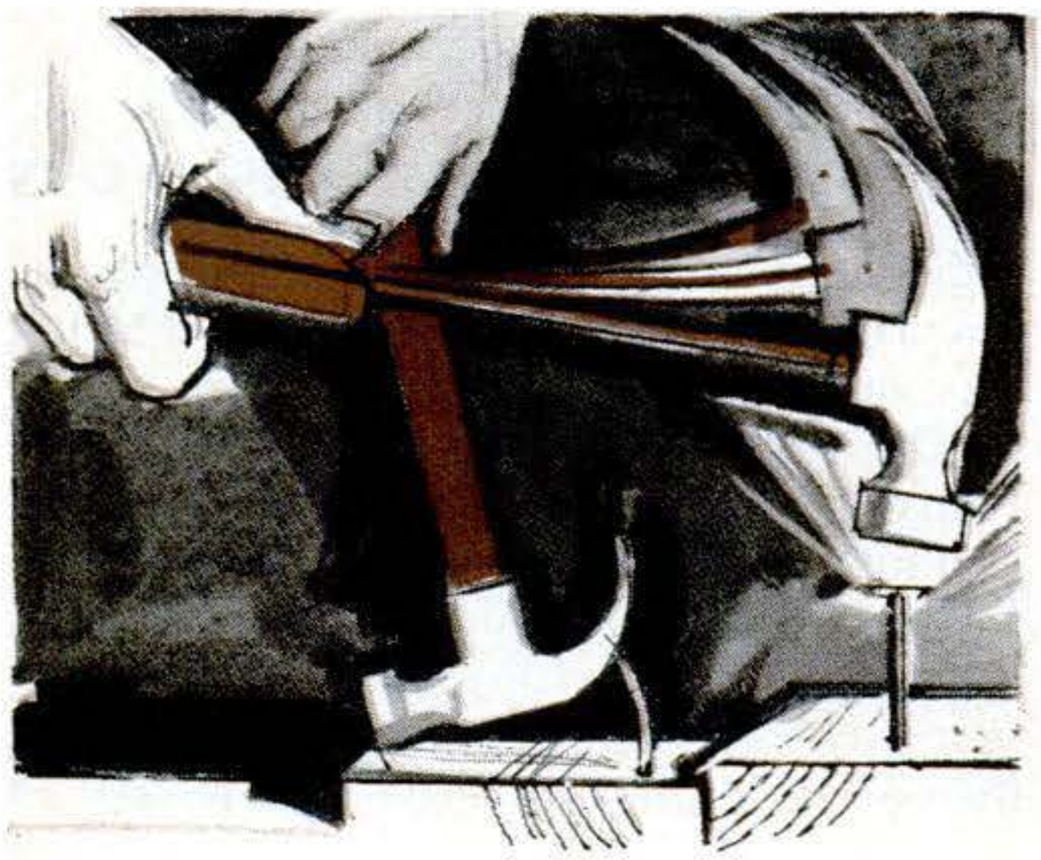
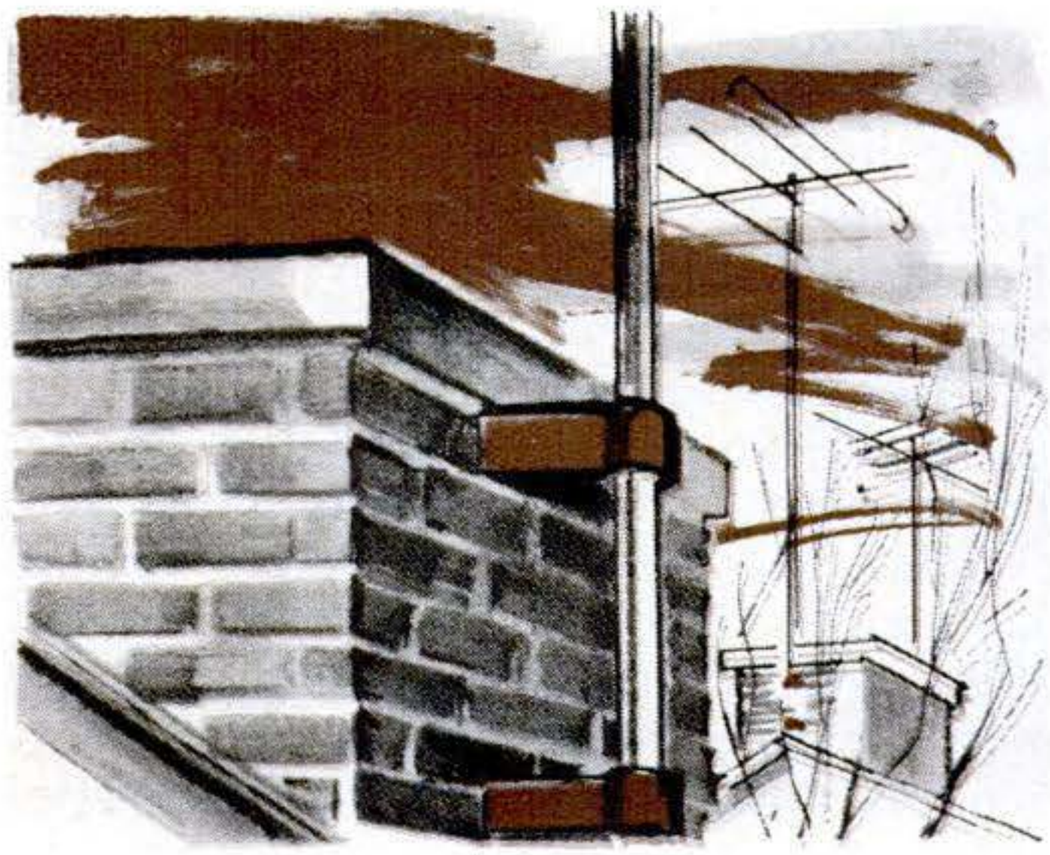
New Ideas from the Inventors

1 Wreath Brightens Car Window. To keep the Christmas spirit on the move, this recent patent proposes a frame arrangement for displaying—and bracing—an illuminated wreath in a car window. Contact strips and wire-supporting upholstery pins would be included for neat, no-dangle hook-up to the car's battery.

2 Whip Shaft Adds to Hammer Force. This flexible handle would reinforce your hammer blows to let you drive nails harder, faster and with less effort. The flat, springy bar could be turned 90 degrees—that is, parallel with the claws—for rigid nail-pulling leverage.



3 Brickwork Has Antenna Mount. You wouldn't have to attach mast supports to the chimney of a new house if bricklayers set these flanged pole holders right into the mortar. Setscrews would lock any standard-size television mast into the two tapered-oval sockets.



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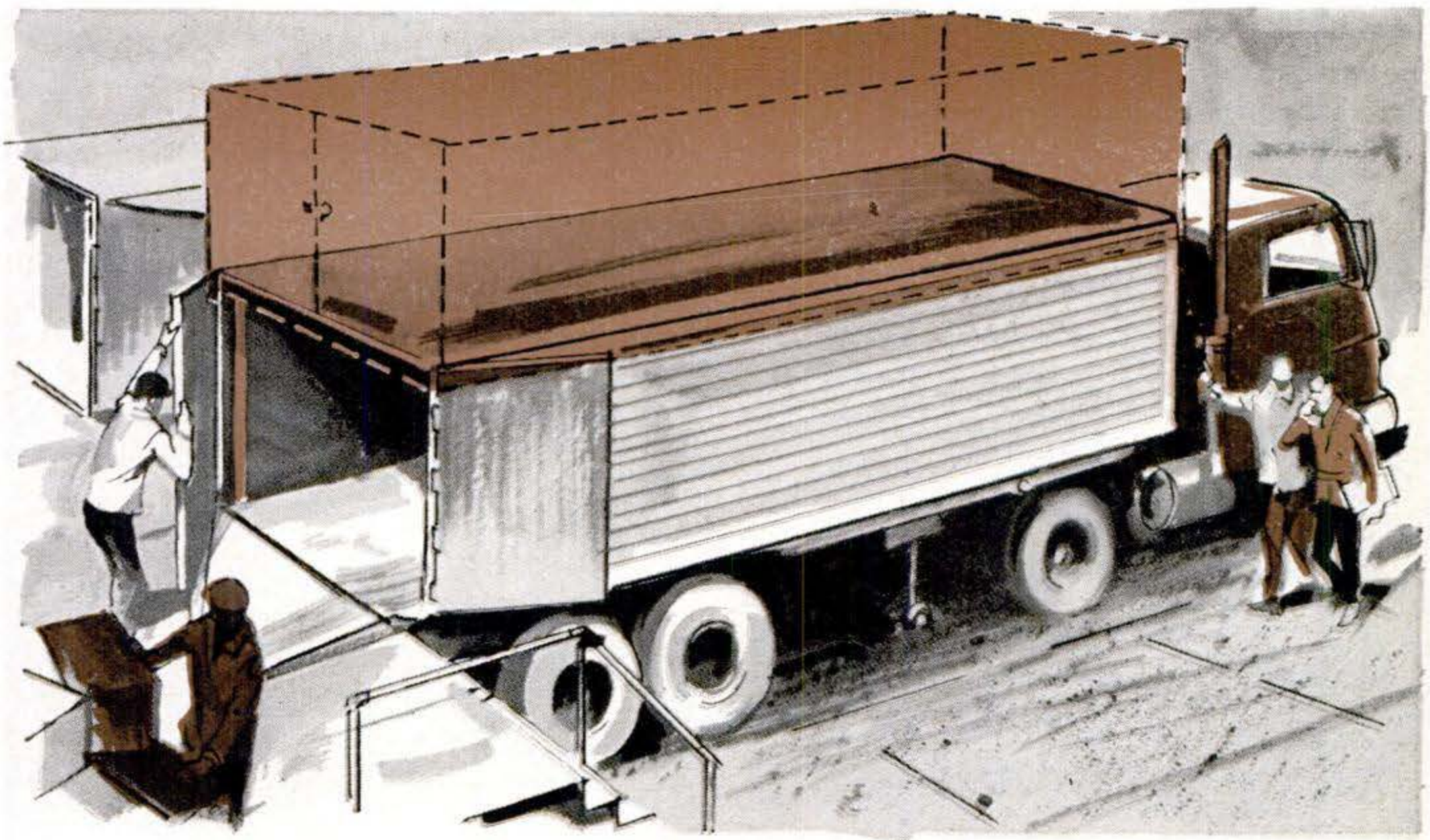
4 Glassless Glasses Cut Glare. Black-edged wire louvers, says this inventor, would shade your eyes without darkening or distorting natural colors. Since they'd deflect—but not filter—bright light, they could be changed from sun to night-driving specs by adjusting louver angle.

5 Door Bumper Guards Car Side. There's no sure way to prevent door-to-door contact from parallel-parked cars, but these bumpers might prevent dents and scratches. In one version they'd be attached by suction cups, in another by hooking onto special trim strips.

6 Truck Lowers to Cut Drag. With a vertical-lift mechanism operating off the tractor's hydraulic system, the roof of this trailer could be raised when necessary for maximum loading. At other times it would telescope to improve roadability, cut wind resistance, or save on heating or refrigerating costs.



Please turn the page for more new ideas

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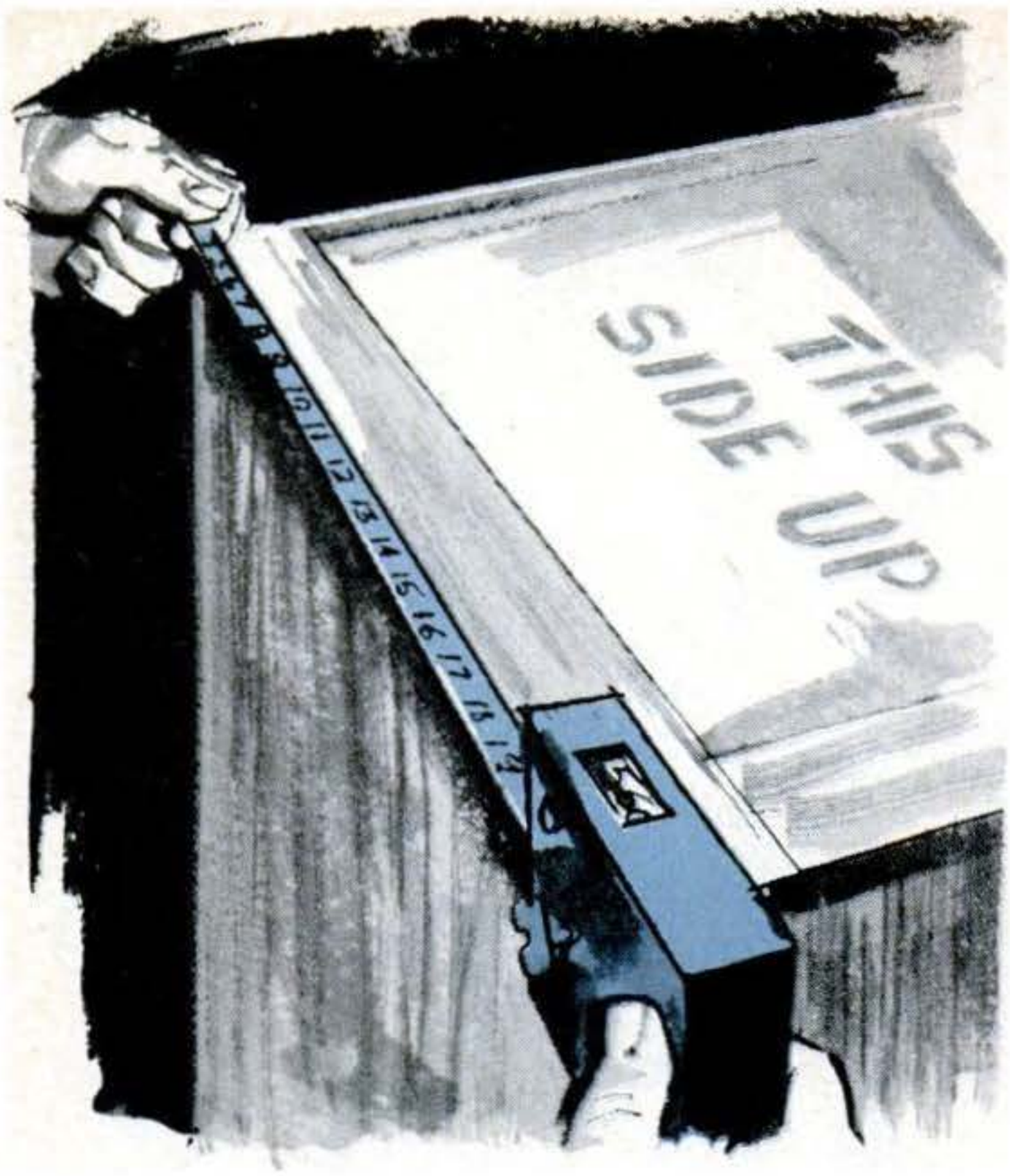
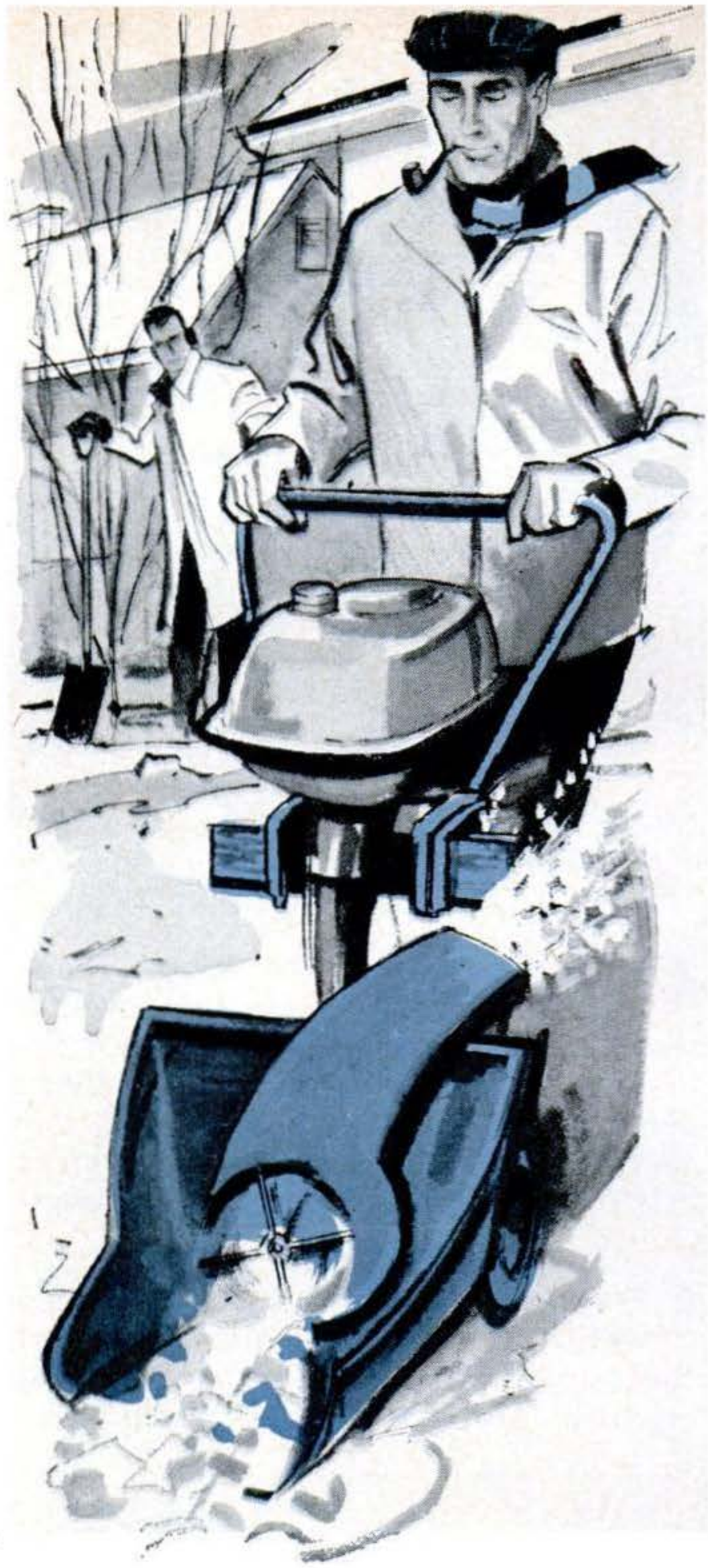


7 Tape Measures and Multiplies. Figuring cubic or square footage should be easy with this Navy-patented rule. Pulling the tape would advance a toothed scale. The scale, calibrated according to logarithmic law, would multiply one length by the next, giving the product.

8 Car Dispenser Brews Coffee. You might need fewer road stops on a long drive if you had a water-heating, under-the-dash dispenser stocked with tea, instant coffee, and other supplies. An electric coil would quickly boil a small amount of water; as you drew off the water it would be automatically replenished from a larger storage tank.



9 Outboard Drives Snowplow. You might get an extra season's use from your outboard by hitching it to a snow scoop. The motor would be clamped upright in this frame and its prop shaft coupled to a blower fan. The fan—aided by exhaust gases—would eject scooped-up snow. Melted snow would cool the engine.

The following patents *have been issued on these inventions: 1. Patent No. 2,753,441 to D. Kuykendall, Watts, Calif.; 2. No. 2,809,684 to E. Lyon, Jefferson, Iowa; 3. No. 2,831,339 to D. Jones, Olmsted Falls, Ohio; 4. No. 2,824,308 to R. Duncan, Northbrook, Ill.; 5. No. 2,734,765 to M. Henderson, Eglin, Fla., and D. Bednarczuk, Flushing, N. Y.; 6. No. 2,821,428 to R. Webster, Rhinelander, Wis.; 7. No. 2,824,374 to I. Abrams, Berkeley, Calif., H. Hughes, San Antonio, Tex., and L. Krauss, San Francisco; 8. No. 2,828.781 to C. Hammack, Barrington, Ill.; 9. No. 2,827,714 to W. Hyde, Minneapolis.*

Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington 25, D. C., at 25 cents each. To write to an inventor, if the address given above is insufficient, you may address him (by name and patent number) in care of the Commissioner of Patents.

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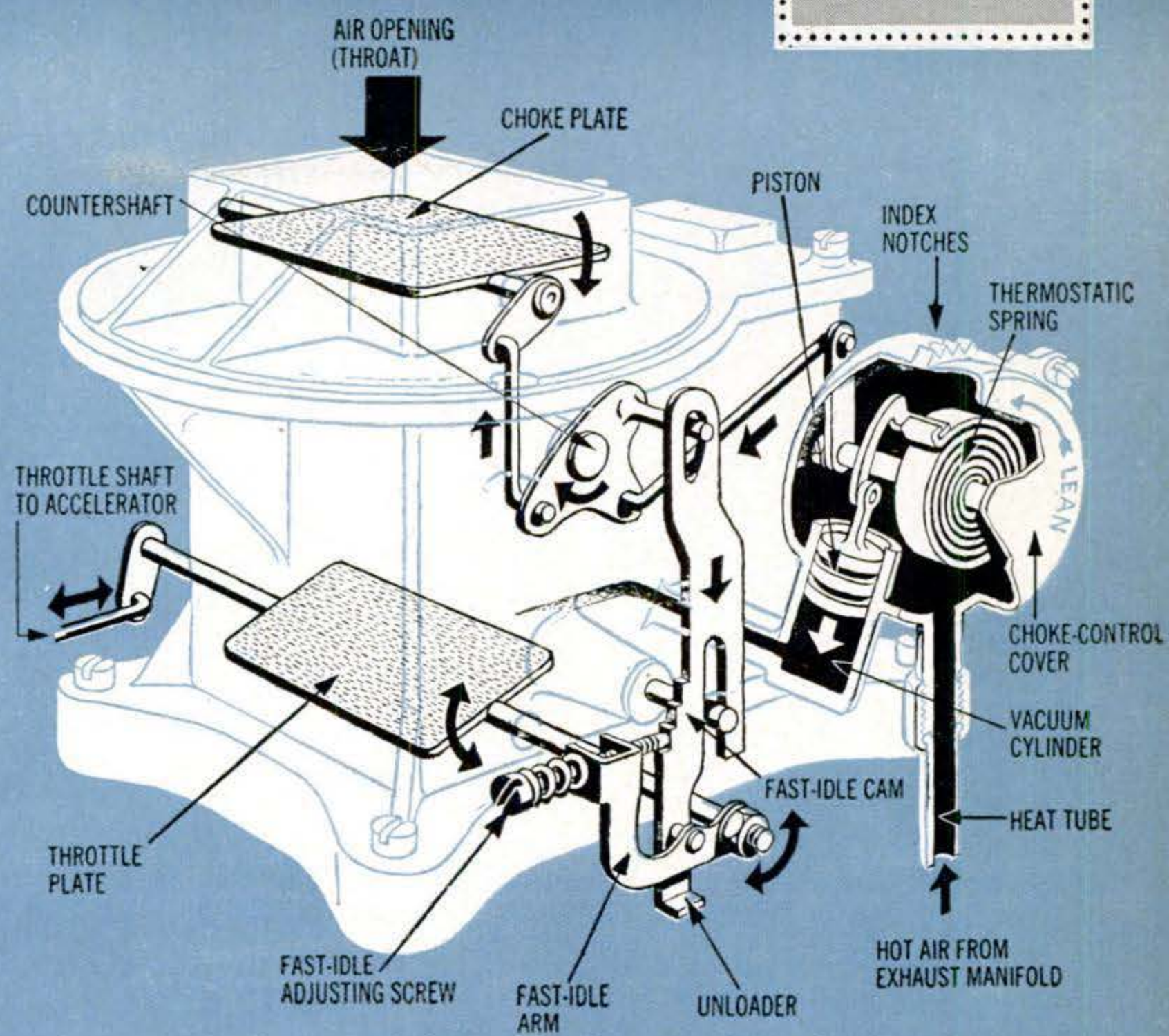
How your automatic choke works

HEATED AIR, entering the choke-control unit through the heat tube (lower right), causes the thermostatic spring to lose tension. This moves the linkage connected to the choke plate and fast-idle cam. As the engine warms, the linkage opens the choke plate and drops the fast-idle cam away from the fast-idle adjusting screw. The choke-control piston operates on manifold vacuum, working against the thermostatic spring to help open the choke. The unloader opens the choke plate wide when you shove the accelerator down to the floor.



If you're troubled by hard starting, or use more gas than you should, it'll pay you to review the rules for—

Economy Driving with an Automatic Choke

By Phil McCafferty

TO SPARE you the nuisance of fiddling with a knob on the dash, car engineers perfected the automatic choke. Yet the little round box on the side of most carburetors is often first to be blamed for hard starting, flooding or poor gas mileage.

Actually, much of the trouble may be traced to the way the car is driven and maintained. Habits carried over from manual-choke days can strangle a perfectly adjusted automatic choke and defeat its purpose. For instance:

Hard starting when cold is often caused by ignoring the manufacturer's instructions and *not* depressing the accelerator once before kicking the engine over. Contrary to popular belief, the choke plate does not close itself slowly as the engine cools.

When you depress the accelerator, it trips the fast-idle cam, closes the choke

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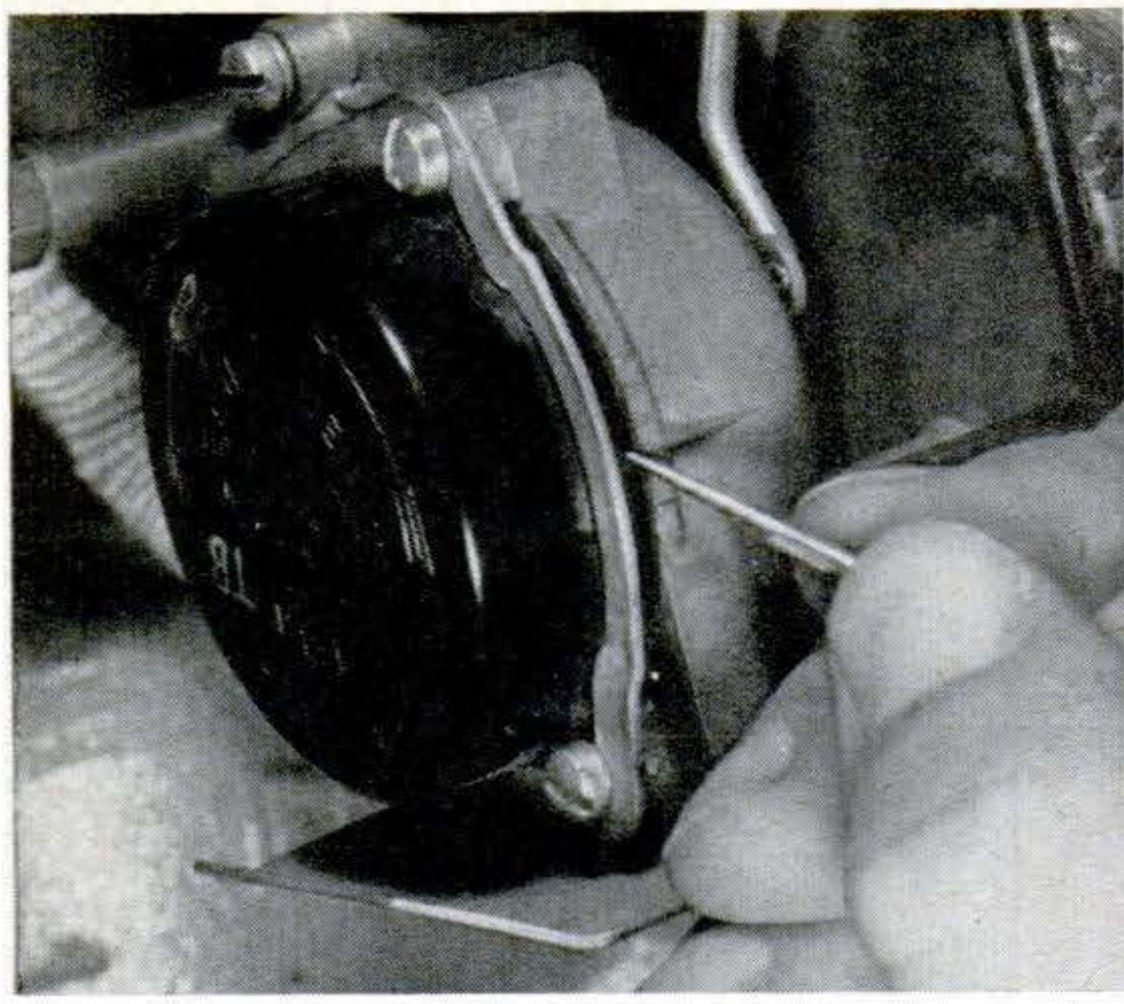

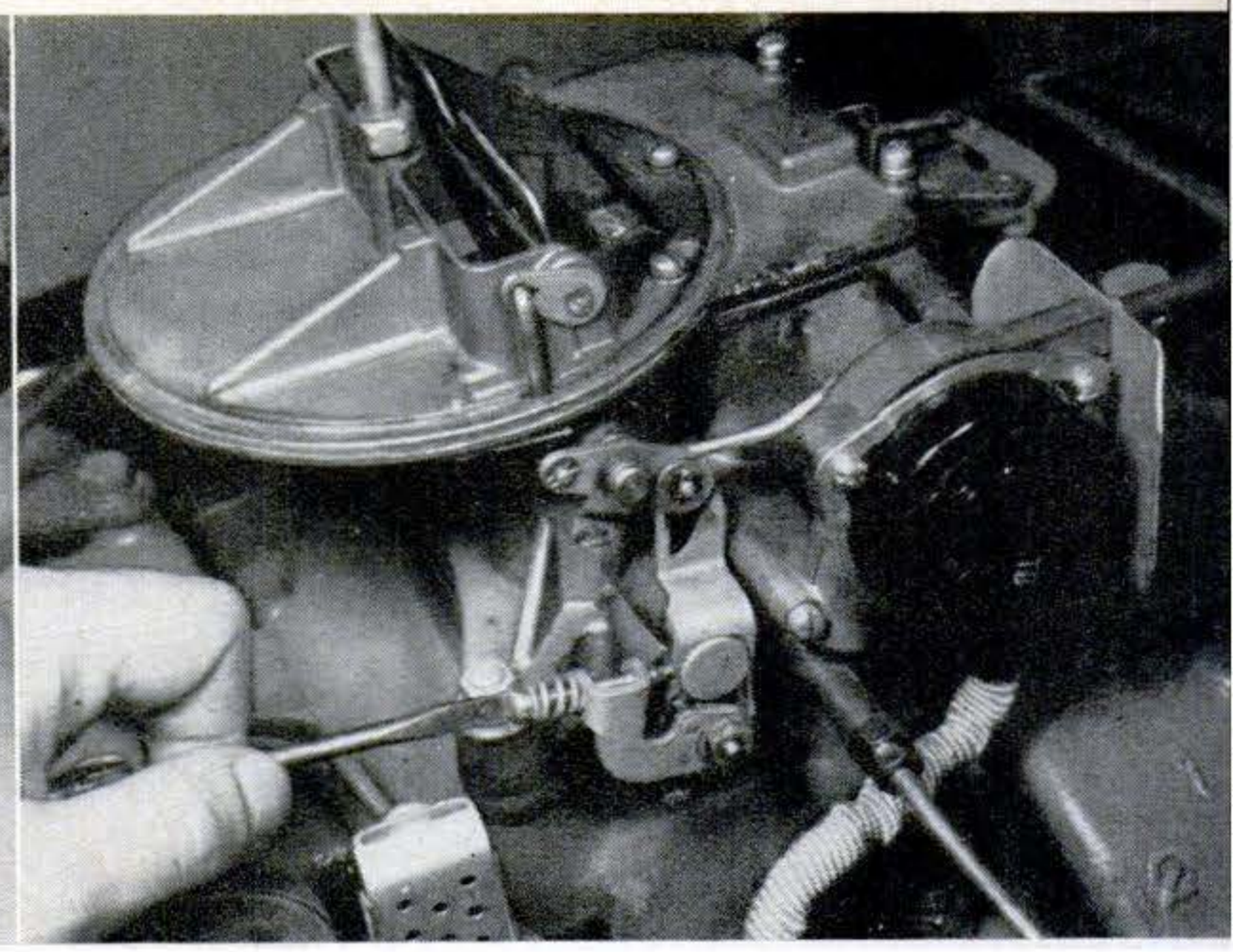

TO ADJUST CHOKE, mark original setting so you can return to it if necessary. If hard starting or sluggish operation when cold is your trouble, turn cap one notch to "rich" side. If choke doesn't open fully at normal operating temperature, turn cap a notch to "lean" side. Adjust regular, or hot, idle with engine warm. Then, with fast-idle cam at its lowest, turn fast-idle adjusting screw until it touches shallowest step on cam. Back off screw about ½ turn to make engine idle faster when cam is in cold position. Readjust slightly when cold, if necessary.

and primes the carburetor sufficiently for an easy start.

Hard starting when hot results from doing what you should have done only when the engine was cold. Depressing or pumping the accelerator loads the intake manifold with raw gas and closes the choke, which has cooled faster than the engine. This leads to flooding. A hot engine should start at the first kick from the starter.

Flooding is caused by using the accelerator too enthusiastically when starting up. If, after trying without success to start, you smell gas or notice wetness around the carburetor body, you have flooded the engine. You can dump the over-rich mixture from the manifold by bringing the unloader into play. Depress the accelerator to the floor and hold it there while you turn the engine over with the starter.

Poor gas economy invariably falls right in the owner's lap. The choke does its job according to the engine's operating temperature, supplying a richer mixture of fuel through all speed ranges when the engine is cold. If you fire up and immediately gun the car out onto the highway at wide-open throttle—brother, you're pouring in the gas. The partially closed choke restricts the flow of air, and the cylinders literally pull the fuel out of the carburetor in a stream. If you're economy-minded, better go easy on the throttle until the engine reaches normal operating temperature and fully opens the choke.

Hard starting, flooding and poor economy can also result from that part of driving most often neglected: periodic maintenance. A dirt-choked air-cleaner element can create the effect of a partially closed choke plate, supplying the engine with an over-rich mixture at *all* times. The choke itself, in time, becomes dirty enough to require cleaning. Knowing how it operates will help you to keep it functioning.

Choke upkeep. Dirt and moisture are the choke control's worst enemies. Have a look at the unit's exposed linkage. Clean it off occasionally, but never oil it. Then check the unit for freedom of movement. Hold the throttle open about halfway to prevent interference from the fast-idle cam and unloader, and operate the choke linkage throughout its range of travel.

Have someone start the engine while you watch the choke (air cleaner removed). The plate should close when the accelerator is depressed, crack open as soon as the engine starts. Feel the resistance against your finger as you try to push the plate closed. It should be noticeable. If it isn't, there is insufficient vacuum or the choke-control piston is sticking. With the engine off, mark the index setting and remove the choke-con-

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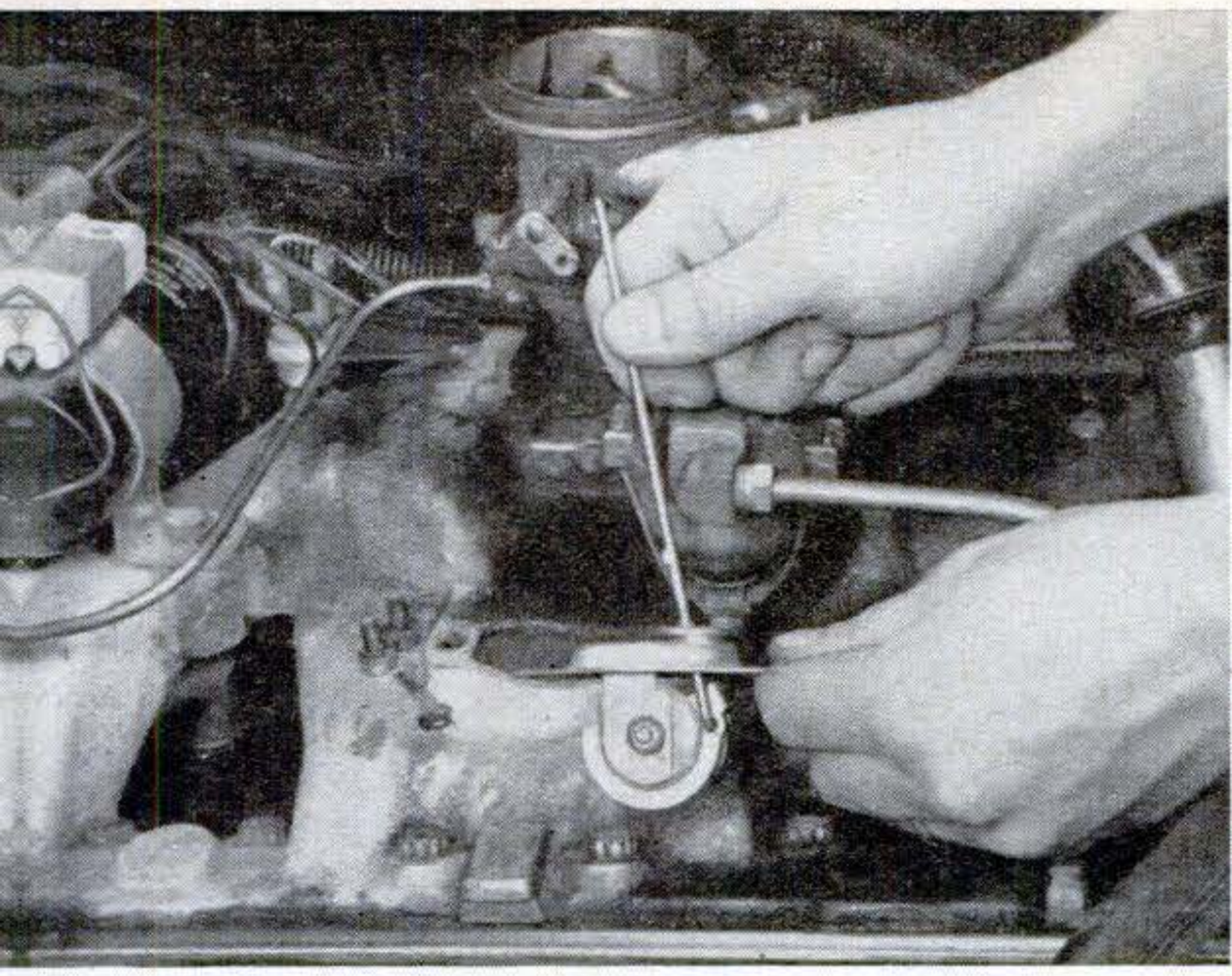
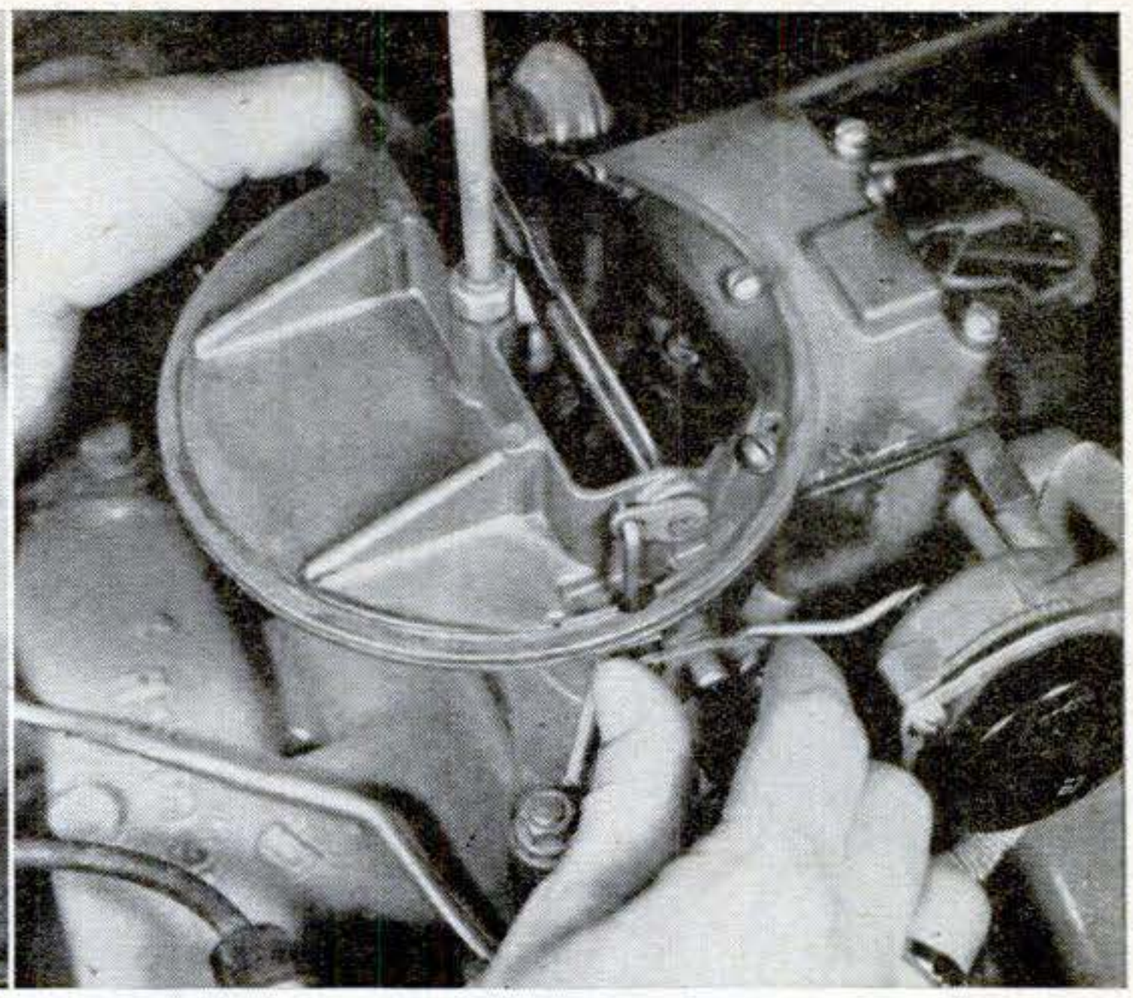
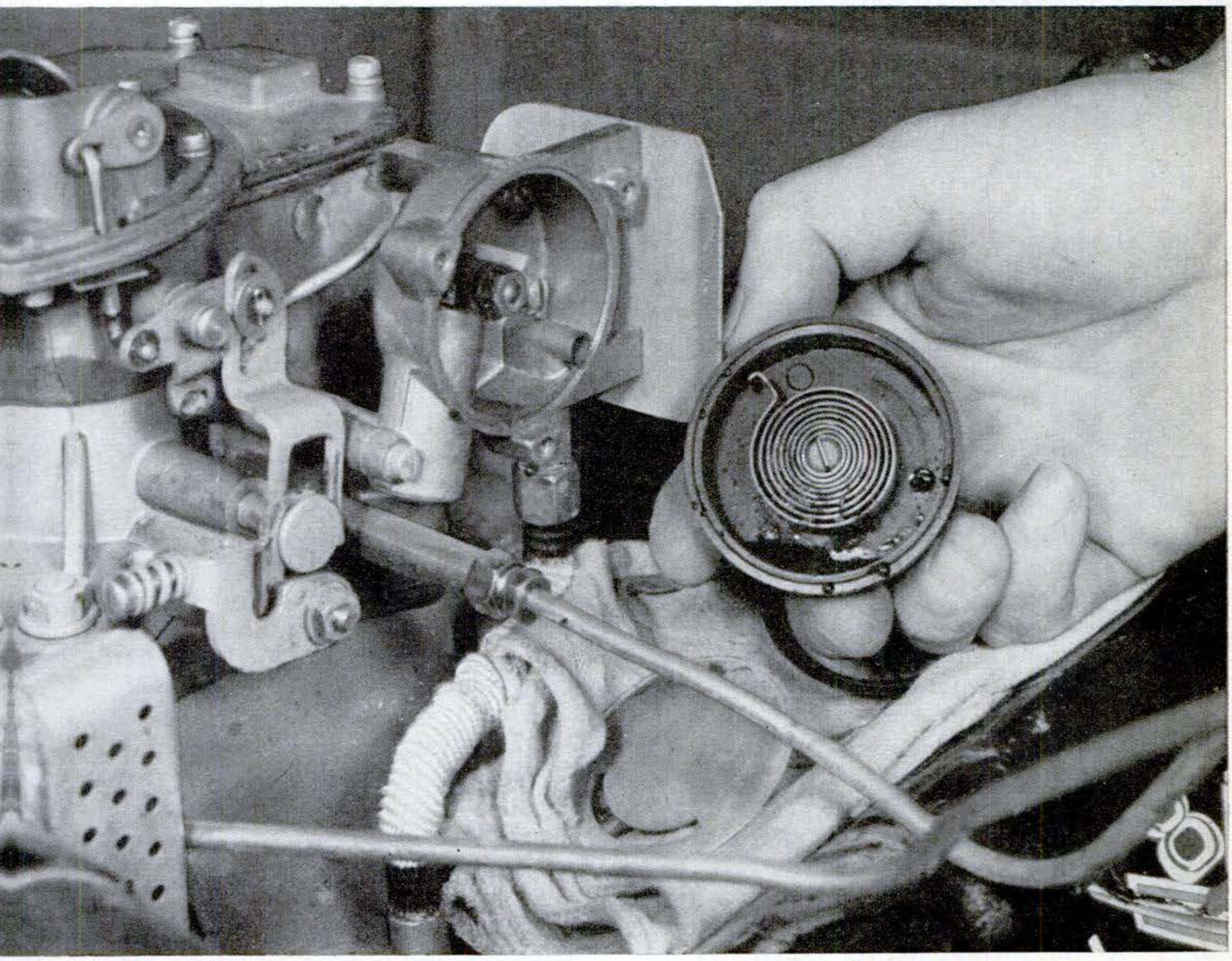


DIFFERENT TYPE of choke control may be found on some Chrysler cars. Thermostatic spring is in a hot pocket in exhaust crossover of intake manifold. A rod attached to spring operates choke plate. Adjustments are easy (index settings can be seen beneath the shaft nut).



CHECK CHOKE FOR STICKING by holding throttle half open and operating choke linkage. If choke plate doesn't open and close smoothly, or if it binds, cleaning of linkage and choke-control unit is needed. Disconnect linkage to be sure that the choke-plate shaft isn't binding.



MOISTURE AND CARBON DEPOSITS inside the choke-control housing, as above, are signs that exhaust gases may be getting through the heat tube. If a thorough cleaning won't free all moving parts, replace the unit. Inspect the heat tube and replace if it's cracked or rusted.

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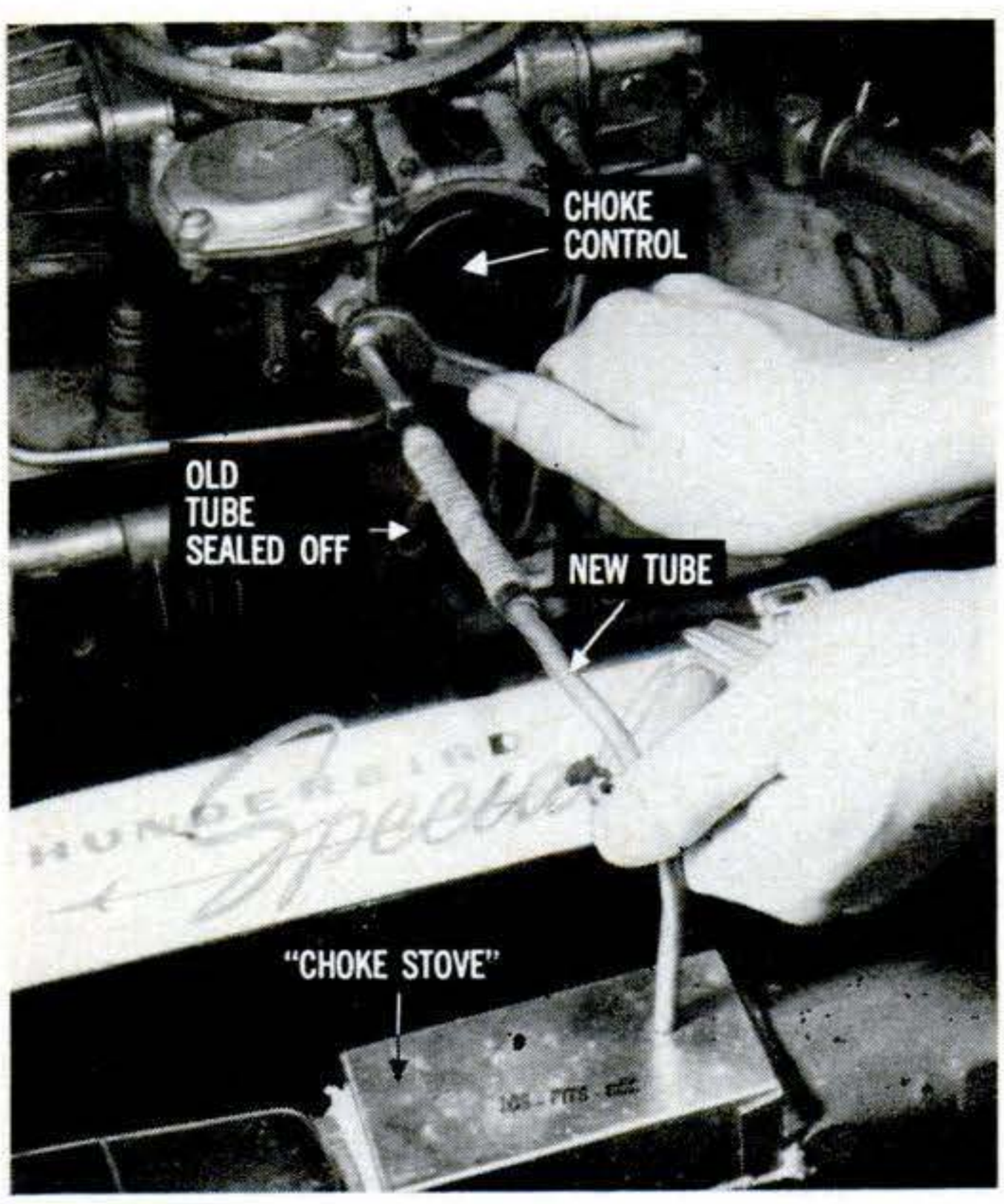

IF A HEAT TUBE BURNS OUT, instead of replacing it you might like to try a product called a "choke stove." The stove uses manifold heat to operate the thermostatic spring. It's made by Brake Parts Specialty Co., 1914 W. Washington Blvd., Los Angeles 18, and costs about $6.

trol cap (usually held by three screws). Push the piston back and forth in its cylinder. If movement isn't absolutely free, remove it for cleaning with carbon tet.

Lack of vacuum usually means a plugged vacuum passage (clear it with an air hose) or a leaky gasket. There's a tiny circular gasket around the vacuum passage between the control-unit body and the carb. A warped or cracked cap can also allow vacuum leaks.

Correct index setting will both save you gas and give you best performance. The index position controls the tension of the thermostatic spring. Index position should be set at tune-up time; and car makers' recommendations for the particular engine-carb combination, such as "two notches lean," "zero," "one notch rich," should usually be observed.

When the index is set too rich, the choke will remain closed too long, or may never fully open. If set too lean, cold-weather starts will be poor because the choke plate won't close. Don't exceed a notch at a time when experimenting, and allow the control unit to cool completely between road tests.

On many cars a heat tube supplies heated air to the control unit's thermostatic spring. The tube, ending in a chamber cast in the exhaust manifold, draws in air through a vent. The air is heated in the chamber and drawn through the tube by manifold vacuum in the carburetor's throat. The amount of heat delivered through the tube controls the tension of the thermostatic spring, which in turn opens or closes the choke plate.

Because the tube is subjected to intense heat and the corrosive action of condensation, trouble in the form of pinholes or cracks is not infrequent. The first indication of trouble is the presence of moisture or black soot inside the choke-control unit, accompanied by hard starting. Unchecked, the control will freeze up with gook. To avoid this, thoroughly clean the control and spring, and install a new heat tube. If the manifold casting has corroded to the point of admitting exhaust gases through the heat tube, an accessory "stove" can be installed on the exhaust manifold and the tube connected to it.

The fast-idle adjustment works with the choke plate to keep the engine idling faster and prevent stalling while it's warming up. If your car's choke control is the type that has the fast-idle mechanism built into it, have the adjustments made when the carburetor is overhauled. In nearly every case, special tools are required to set this type.

When the fast idle is adjustable with an external screw, set it as follows: First, adjust the regular (hot) idle with the engine at normal operating temperature. Then turn the fast-idle screw until it just touches the deepest step on the fast-idle cam, and back it off about one-half turn so it won't interfere with the hot-idle setting.

Car makers figure this adjustment will produce a sufficiently fast idling speed when the engine is cold and the high step of the cam makes contact with the fast-idle screw. If it seems too fast, back off another half turn. The ideal adjustment is one that idles the engine just fast enough when cold to prevent stalling. Some cams have several steps that allow the engine to idle progressively slower as it warms up.

Finally, to keep your automatic choke from being the butt of all your car's complaints, keep the carburetor clean and properly adjusted, the fuel-pump strainer clean, and your foot light on the gas. END

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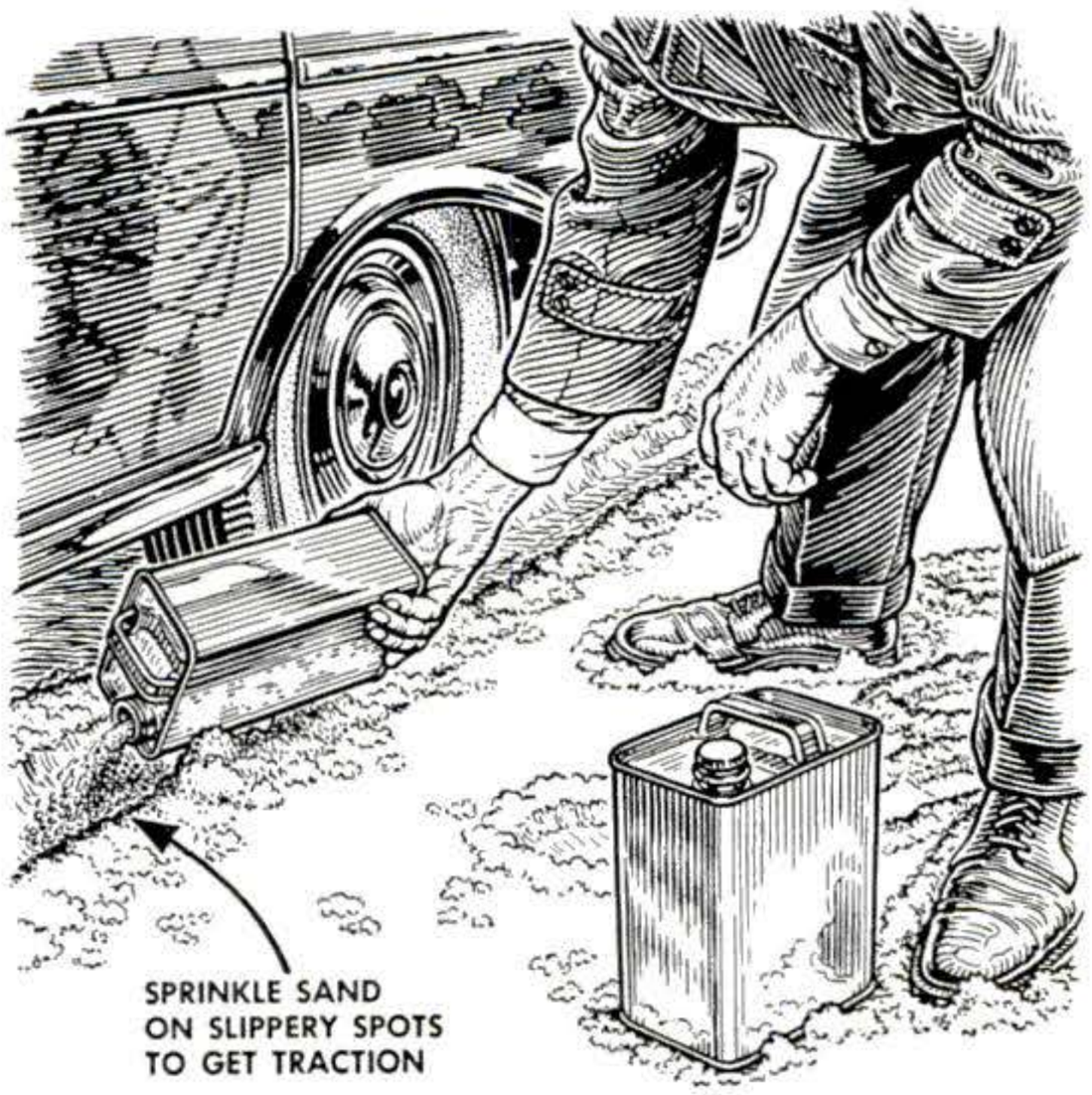
Hints from the Model Garage

A coat of clear acrylic sprayed on license plates will preserve the painted surfaces and keep them looking new—even over several years of use required in some states. The acrylic is also useful for protecting chrome and damp-proofing wires.

Chains won't tangle or rattle in the trunk if you roll them in a strip of burlap. Cut the burlap slightly wider and longer than the chain, and lay the chain out flat before rolling. Heavy rubber bands will keep the rolls intact.



A good way to carry sand for emergency use on ice and snow is in a one-gallon can. Several cans are easy to stow compactly, and sand can't sift through as it sometimes does in bags. Pouring the sand where you need it is easier, too.

For a handy quick-cleaner around a car, try baking soda. A little sprinkled on a damp cloth will quickly remove gasoline stains around the filler cap, take off road-tar spots and spattered insects, and clean and neutralize battery acids.

Please turn the page for more garage hints

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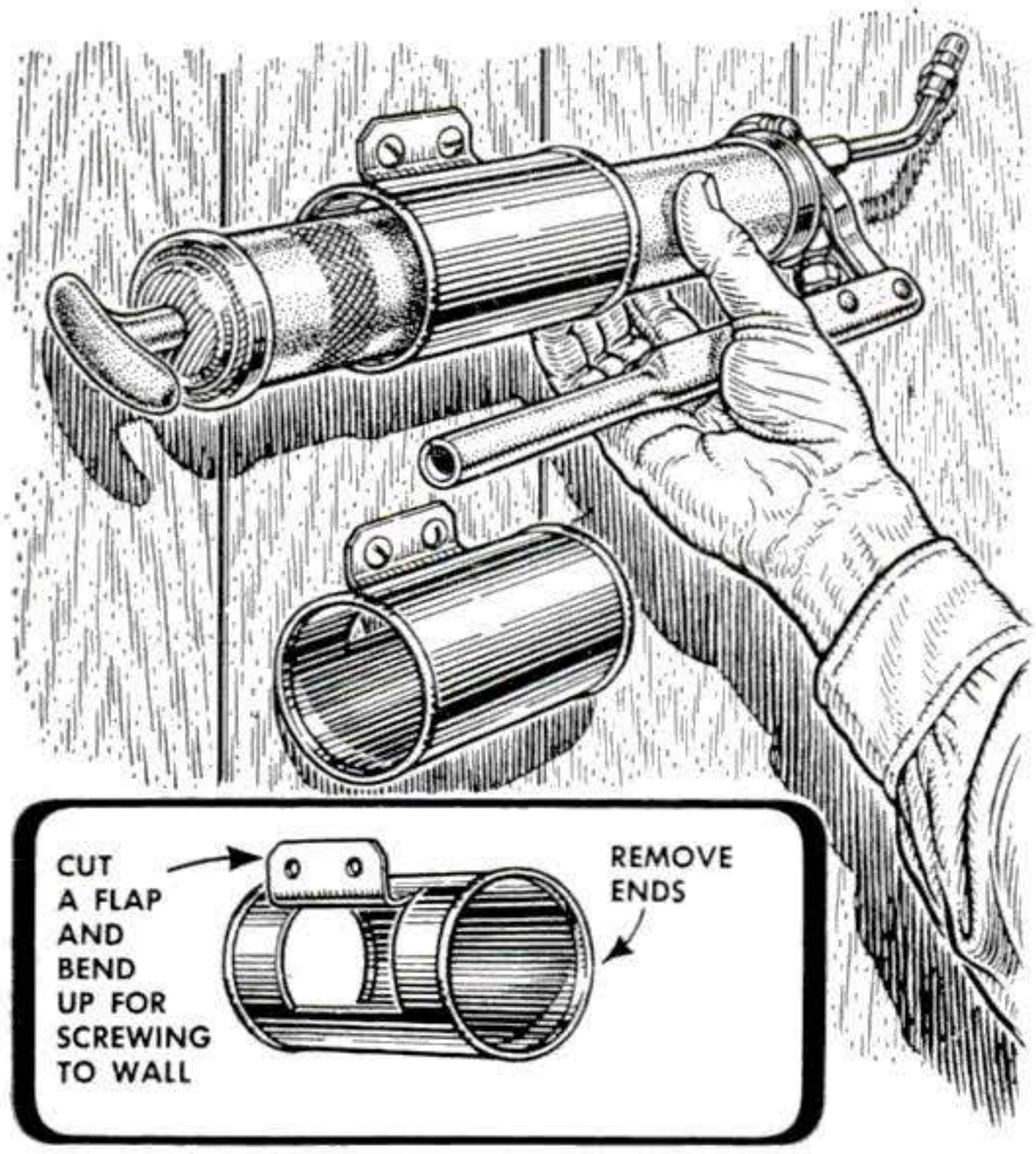
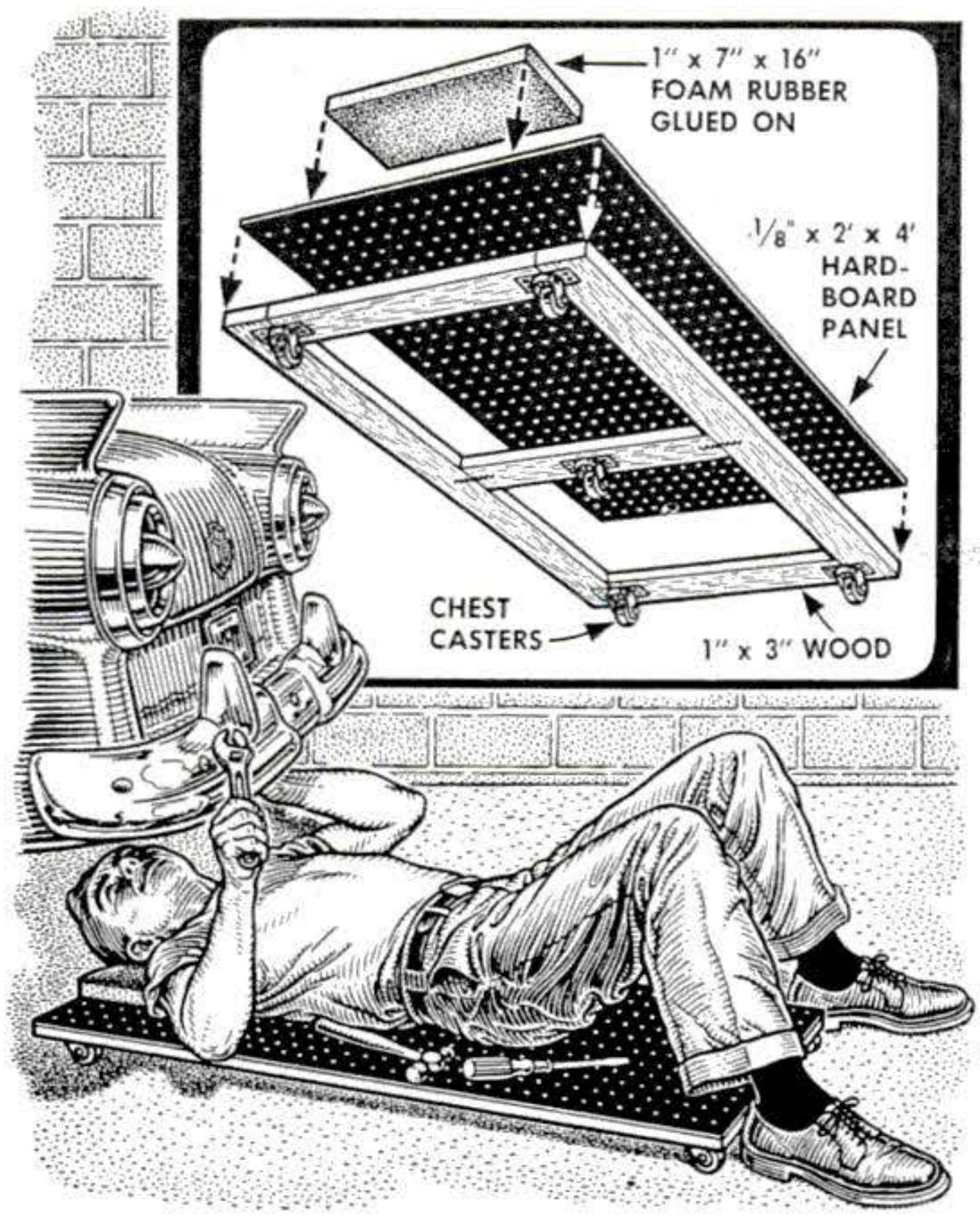
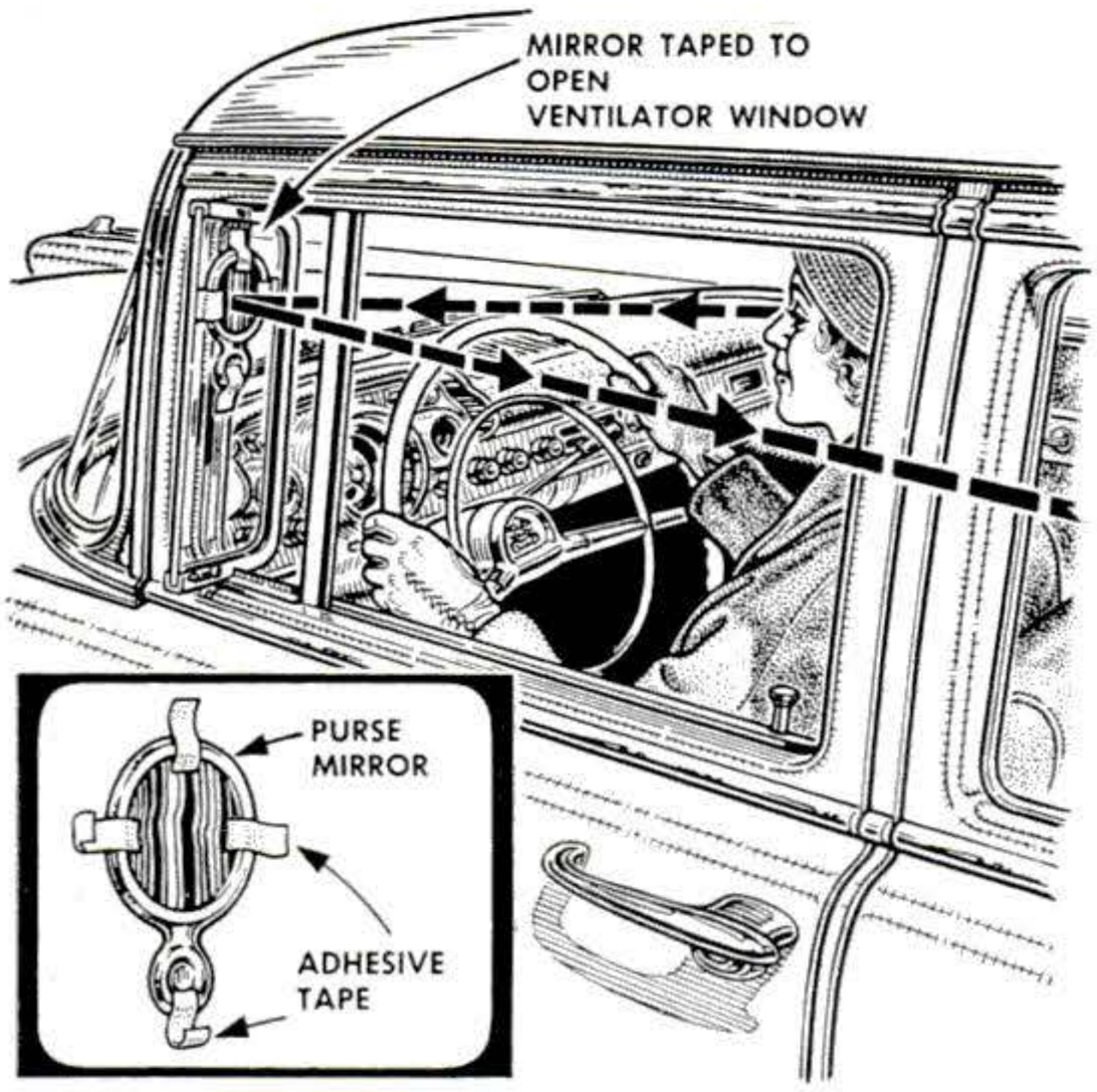
More Hints from the Model Garage



Storing a grease gun, calking gun and many other car and home tools is easy in racks made from discarded tin cans. Remove both ends and cut out a flap in the center of the can. Bend the flap outward and screw it to the wall as shown.



You can build this creeper for about $4.50, and the investment in comfort will soon be repaid when working under your car. For the frame, join one-by-threes with corrugated fasteners. Cover with perforated hardboard and add casters.



If rearward vision is blocked when hauling furniture or bulky packages, a small hand mirror taped to the outer edge of the vent window on the driver's side will enable you to see. Swing the window to bring the mirror into seeing position.

For scraping snow or frost from the windshield, stow a plastic tile in the glove compartment. The tile has four sharp edges that will quickly clear the glass without scratching it, and, being flexible, the tile will bend to fit the curves.

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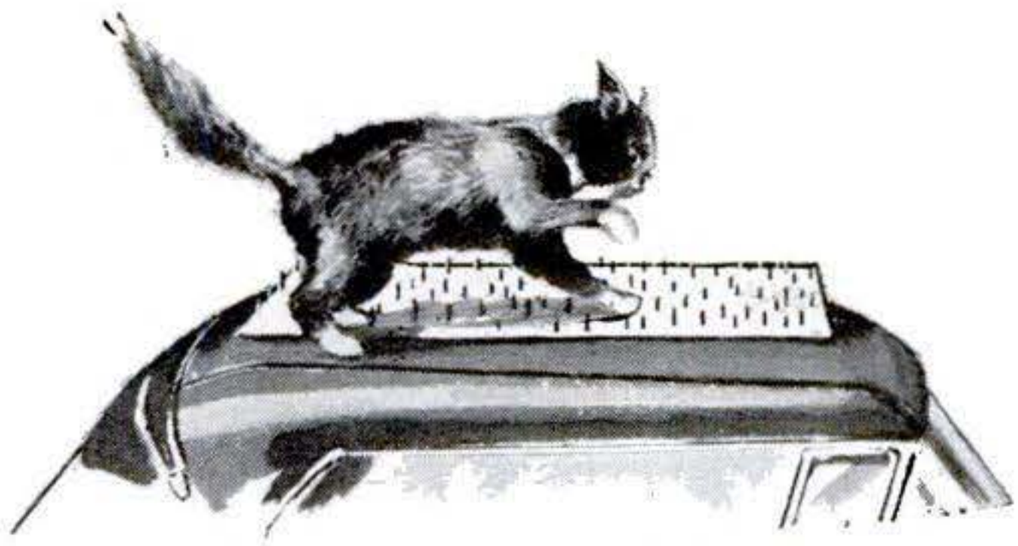


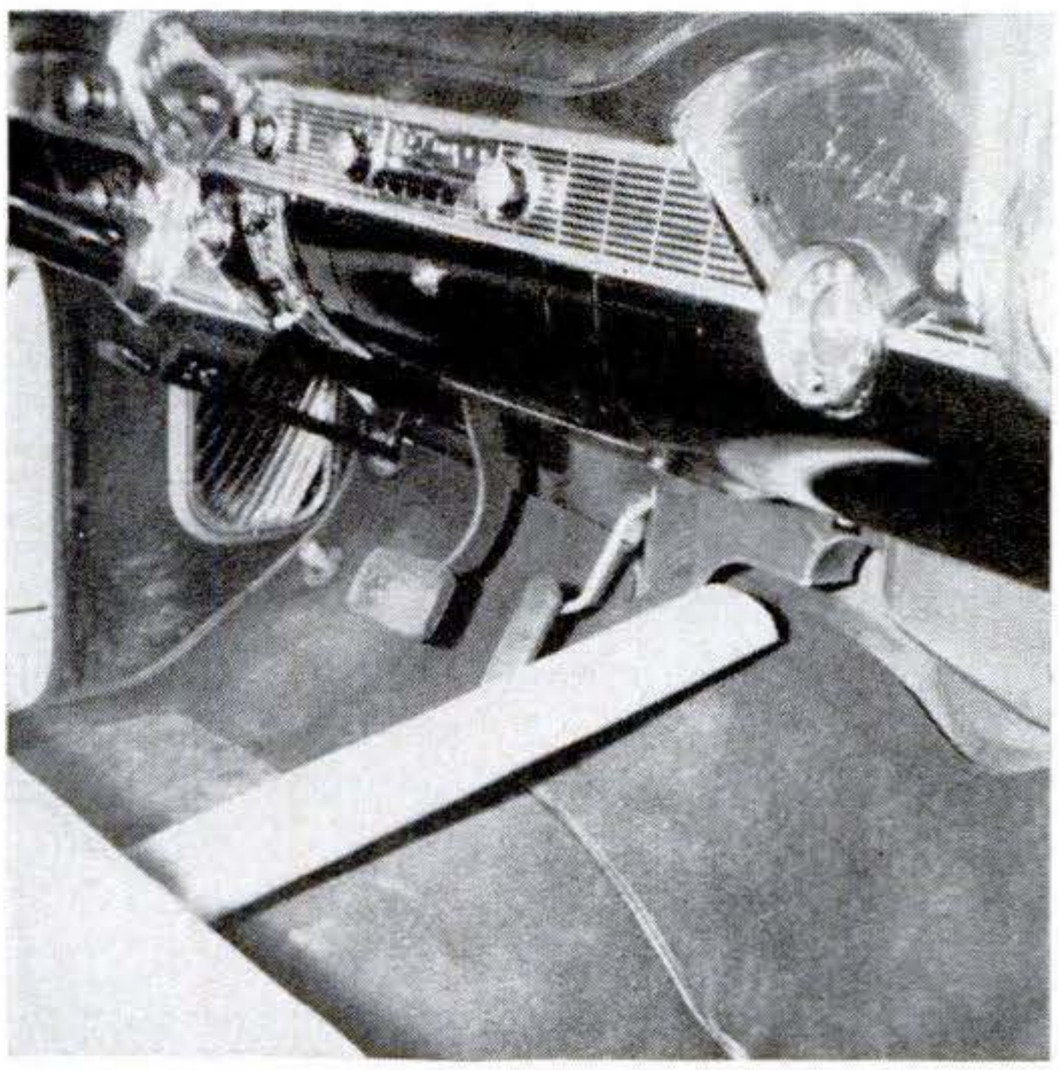
Tacks Keep Cat Off His Car

WHEN we bought a new convertible, a neighbor's cat began sleeping on top of it and cut a small hole in the roof with her claws. We applied an iron-on patch to the underside, pressing against a board held over the hole. That stopped the leak. At night thereafter, we covered the car's soft top with a piece of cardboard with thumbtacks stuck through it. That got rid of the cat.—*David Shaw, La Mesa, Cal.*

▶▶▶CLEANING a front bumper beneath the license plate is difficult and often overlooked. Before long, rust begins in this area. If a pivoted, swing-down bracket is used (the type used over center-fill gas tanks), the entire bumper and grille can be polished without scraping your knuckles.—*A. Smola, Cleveland.*

Light Beam Tests Tires

IRREGULARITIES in the tread of the tire spinning above vary the thickness of a light beam and are measured by a photocell in volts on the machine at right. U.S. Rubber uses the device to test roundness.



Piping Heat to the Back Seat

REAR-SEAT passengers in my convertible are warmed by heat piped back to them under the front seat. I used a 26″ length of 3″-diameter rain spouting, flattened slightly at both ends to make it fit. —*G. R. Wolfe, Akron, Ohio.*

Special Jeep Starts Dead Cars

TERMINALS in his jeep's grille allow D. L. Dennis of Findlay, Ohio, to boost the battery of a stalled car without raising the jeep's hood. He uses two batteries, connected in series by a switch, for servicing both six- and 12-volt batteries.

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Gus Clears the Way for Christmas

Pop Sawyer just lived for the annual Christmas visit with his family. Why in the world did he refuse to go this year?

By Martin Bunn

THE old man coming down the street toward the Model Garage walked slowly, his back bent as if he were accustomed to carrying a heavy load. It was Pop Sawyer, who had been retired as a mail carrier for many years.

"Hi, Pop," Gus Wilson called, as he hung up a gas hose. "Getting ready for your annual Christmas visit upstate?"

The old fellow turned and straightened up. Blue eyes peered from beneath gray eyebrows. "Mmm, don't know about that, Gus. My bones tell me we're due for some bad weather. Don't let this mild spell fool you. Probably have a blizzard come Christmas time—and I wouldn't want to get caught driving over those back-country farm roads."

"That reminds me," Gus said. "I haven't seen you driving your car lately. Something wrong with it?"

"Why should there be?" Pop Sawyer snapped angrily. "Can't a fellow walk if he wants to without folks thinking his car's busted?" He turned abruptly away from Gus and ambled down the street, mumbling.

"Grumpy, isn't he?" said Stan Hicks,

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As Gus had expected, the old man tossed on his hat and coat and went with Stan.

Gus's assistant, crawling out from under a car.

"No, Stan, that was just his pride showing. I'll bet my bottom dollar his car is laid up and he can't stretch his pension to cover a garage bill."

"But he knows you'd fix his car without charge, just for old times' sake."

"That, Stan, is just why he won't admit there's anything wrong with his car."

"Then why doesn't he take a train or bus?" Stan asked.

"And tip off his daughter and son-in-law that he can't afford to drive a car?"

Stan gave his boss a quizzical look. "Sure you aren't imagining things, Gus?"

"Pretty sure," Gus said. "Pop lives from day to day looking forward to that Christmas visit with his grandchildren. When he dreams up nonexistent blizzards, he's covering up."

"Well," Stan commented, "there's nothing you can do about it."

"Can't I now?" Gus said. "You may not remember, but Pop Sawyer probably was the only mailman who was never bitten by a dog. Why, folks even used to call him in to doctor their sick pups instead of calling the vet."

Stan laughed. "Going to suggest that

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Pop Sawyer make the trip by dog sled?"

"No, but a dog may turn a trick for me. Maybe we can use that old hound dog of yours, Stan."

Stan looked puzzled.

"Listen," Gus said. "Tonight you drive out to Pop's house and tell him that your dog is sick. Sure as shootin', he'll go along to your place for a look. Then I'll slip into his garage and give his car a quick once-over. Probably nothing much wrong with it."

"Sounds dandy," Stan said. "But how are you going to let him know that his car is back in running shape—if you are right about its being broken down—without letting him know you fixed it? And even if you manage that one, how will you explain the automatic fix-it job?"

"That's a bridge I'll cross when I come to it," Gus said. "Now we'd better get back to some Model Garage business."

THAT night Gus had his car parked up the street from the little house where Pop Sawyer lived alone since his wife's death. He saw Stan Hicks drive up, get out to knock on the door. Pop Sawyer's reaction to the tale of a sick dog was just what he had expected. The old man tossed on his hat and coat and went off with Stan.

When the car turned a corner, Gus drove around to the back of Pop's place, slipped through the yard into the unlocked garage, tool kit in hand. He got behind the wheel of Pop's vintage sedan, threw the ignition switch, stepped on the starter. The motor turned over briskly, but didn't start. With the beam of his flashlight on the dash, Gus noted that the gas gauge read half full, but that there was no flicker of the ammeter needle as the engine turned over.

"Just as I thought," he mused. "Nothing wrong here but fouled ignition points."

Gus put up the hood, removed the distributor cap, put the car in gear, and rocked open the points on a lobe of the cam. After he had filed and set them to proper gap, he rocked the car to close the points. Then he pulled the secondary, high-tension wire from the center of the distributor cap, held it close to the block, and snapped the ignition points open with his thumb. No spark jumped from the coil wire, indicating a faulty condenser or coil. Gus broke out his tester, flashed his light about, looking for an electrical outlet; there wasn't any. With his tester useless, he'd have to take other measures.

He removed the primary ignition wire from the side of the distributor and, with the switch on, flicked it against the block. Again there was no spark. Now Gus knew he had the problem tied down. It could be a faulty ignition switch, a loose or corroded connection in the primary ignition wire, or a faulty wire itself. Working fast, he thrust his head under the dash, played his flashlight on the ammeter post where the primary wire led off to the live side of the ignition switch. As he shorted the post to the metal dash with a screwdriver, there was a shower of sparks. He quickly attached a jumper wire across the ignition switch, cutting it out of the line in case it was faulty. Then he got out and struck the distributor end of the primary wire against the motor block.

"Hah!" he grunted when no spark came. A faulty wire from switch to distributor needed replacement.

Gus unwound a length of primary wire from a coil in his kit, and was just about to cut it off when he noted how the new wire stood out, red and brilliant in his flash beam. Pop Sawyer would be sure to note the new wire, in contrast to the old and grease-blackened primary. He would have to find the break in the old wire and make the repair so that it wouldn't stand out like a sore thumb. Thrusting his head and shoulders under the hood, he was following the wire with his flash, when something hard was poked into his back.

"Get your hands up, mister!" ordered a crisp voice. Gus obeyed, dropping his light. "Now, back out of there slowly and no tricks. That's a gun in your ribs."

The chill went out of Gus's spine as he recognized the voice of his friend, State Trooper Jerry Corcoran. "Take it easy, Jerry," he said, twisting around so that his face came within the beam of the officer's flashlight.

"Well, I'll be—" Corcoran exclaimed. "Gus Wilson! I thought you were a burglar. What are you doing prowling around Pop Sawyer's garage at this time of night?"

"Put that bazooka down and stop asking questions." Gus stooped down and examined the flashlight he had dropped. It

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wasn't working. "Here, Jerry, shine your light along this wire. Hurry, now. We've got to get this car fixed before Pop comes back and catches us in the act."

"What act—say, what's this all about, Gus?"

"Never mind. Just run your light along here. Ah-ha, there it is! I'll just cut the wire at the break, splice it, and hide the tape behind the block." Gus looked up. "Get me a pair of cutters and a roll of tape out of my tool kit over there."

"What the heck—" began Corcoran. Then he shrugged his shoulders. "Oh, what's the use?" He played his light into the tool box. "Here's your tape and pliers."

"Thanks. Now aim your light down here."

As Gus got to work, staccato blasts from a car horn came from up the road. Corcoran tapped Gus on the shoulder. "We'd better get out of here. I don't want to be caught aiding and abetting a criminal."

"That's just Stan bringing Pop back. Keep your light steady." Gus cut the wire, bared the ends, twisted them together and applied tape. Then he shoved the repair job behind the block.

"I hope that does it," he announced. "Put that light out and let's scram."

Just then a car pulled up in front, and as they slunk away like two conspirators, Stan's over-loud voice broke the stillness, "Sorry I got you out for nothing, Pop, but thanks."

THE next morning, which was the day before Christmas, Gus was careful to be in front of the Model Garage, loading his pipe casually, as Pop Sawyer took his usual stroll.

"Hi, Pop," he said. "I asked you about your car yesterday because the last time you drove in here for gas I heard a sort of snapping noise. Been thinking about it ever since."

Pop looked up, quick interest in his eyes.

"Yeah," Gus continued. "Sounded as if the wire in the top of your coil was out of the terminal socket a bit so the spark had to jump a gap. Better take a look at it. Thing like that could cause you trouble some day."

"You wouldn't be kidding me, would you, Gus?" Pop Sawyer's veined hand shot out to grip Gus's arm. "No, I guess you wouldn't kid a man about a thing like that—not at Christmas time. I'll look into it, right away."

He turned to retrace his steps toward home, spring once more in his step, hope glinting in his eyes.

"I wonder what this button does."

Less than an hour later Pop drove up in his car and parked in front of the pumps. "Fill her up," he said as Stan came out of the garage. "And better check the oil, too. It's a long drive up to my daughter's farm and I don't want to stop for anything on the way."

As the old man pulled away, Gus joined his assistant. "How come he didn't suspect anything?" Stan asked.

"Nothing to it," Gus said. "Just before Jerry and I scrammed, I jerked the high-tension wire a bit out of the coil terminal socket. He couldn't help but spot it after I gave him a hint."

Stan grinned. "Bet I know what you're gonna ask Santa for Christmas—a new set of burglar's tools." END

Next Month: Gus rescues a rookie cop.

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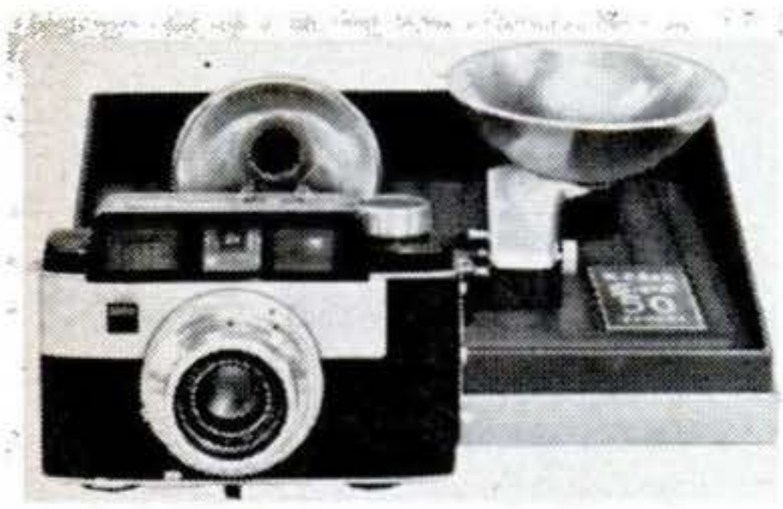
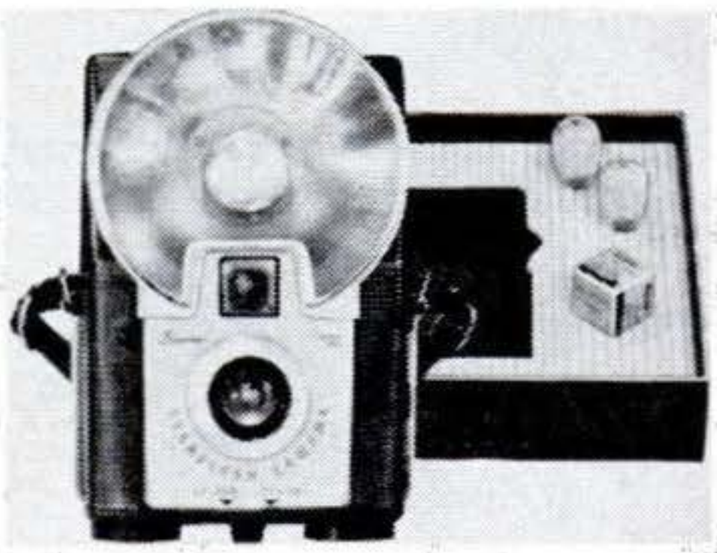
Open this new Kodak Signet 80 Camera *first*, and start taking 35mm color slides. Has exposure meter, rangefinder, *f*/2.8 lens. Accepts wide-angle ($57.50), telephoto ($69.50) lenses, multiframe finder ($17.50). Signet 80 Camera with *f*/2.8 lens, $129.50.

Kodak gifts say *Open me first!*



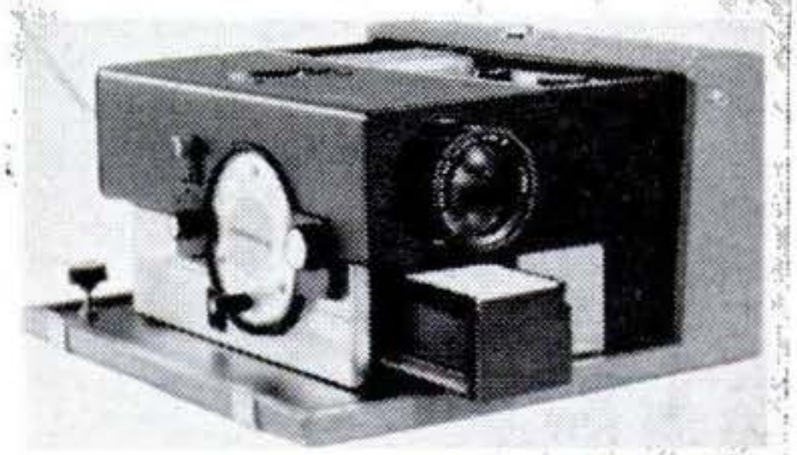
Kodak Signet 50 Camera has built-in light meter, EV-linked lens-shutter, *f*/2.8 lens; with flasholder, two reflectors, $82.50.

Brownie Starflash Outfit —for snapshots and *color slides*, too! Built-in flasholder, bulbs, batteries and film. Only $9.95.



Kodak Duaflex IV Flash Outfit — everything for snapshots, indoors and out! Camera, flasholder, bulbs, batteries, film, $24.95.

Kodak Cavalcade Projector is completely automatic! Changes slides by itself. Steel jackets protect slides. 500 watt, *f*/2.8 lens. $149.50.



Many photo dealers offer terms as low as 10% down. Prices are list, include Federal Tax, are subject to change without notice.

See Kodak's "The Ed Sullivan Show" and "The Adventures of Ozzie and Harriet"

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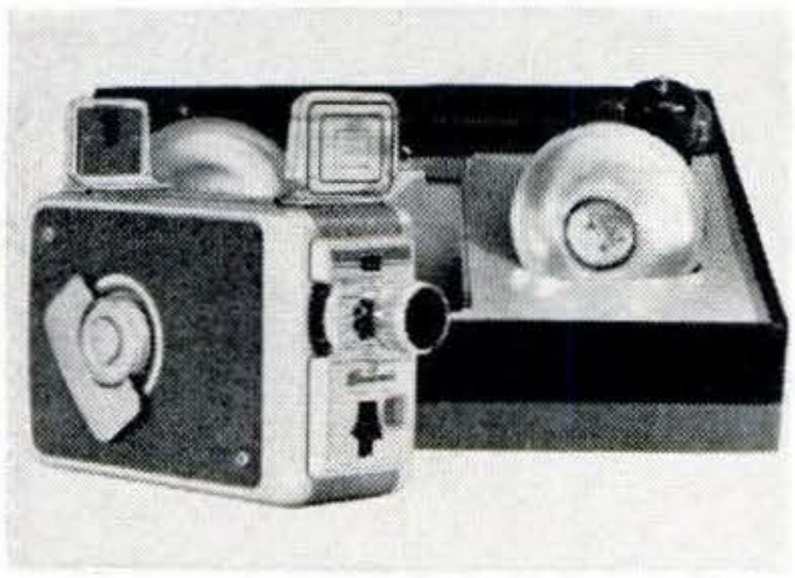
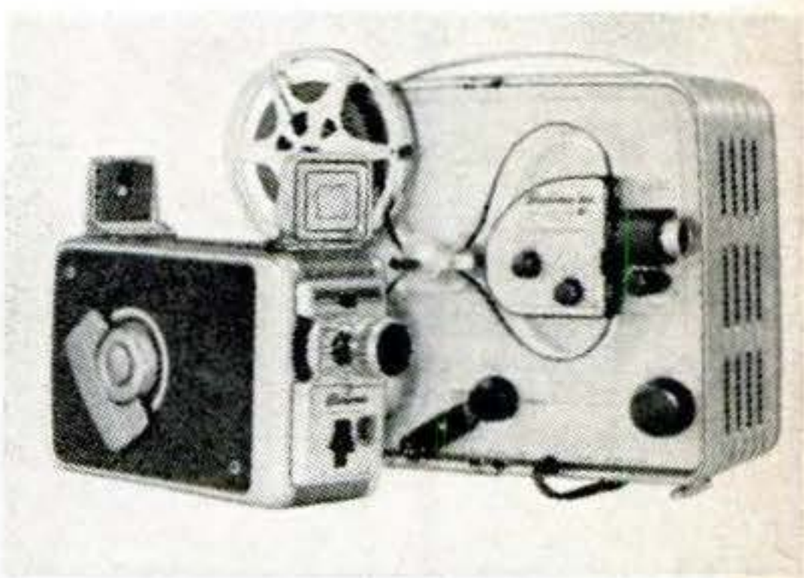
Open me first!

Open the new Scopesight Brownie Movie Camera *first*, and capture all the action and color. Built-in exposure meter always shows you when exposure is correct. Single-lens model, $79.50. Turret model, $99.50.

...and save Christmas fun in pictures!



Brownie Movie Camera Kit, *f*/2.3—8mm color movies, indoors and out, with one setting! Complete with light bar, cord, lamps, $39.95.



Brownie 300 Movie Outfit—8mm camera with *f*/2.3 lens, and projector for showings up to 3 feet wide, reverse, "stills," too. $97.45.

Brownie Movie Camera, Turret *f*/2.3 (8mm)—Lowest priced ever! Takes regular, wide-angle, telephoto shots. *Easy* to use. $59.50.

Kodak Showtime 8 Movie Projector — shows movies up to 5 feet wide! Built-in dry splicer. 750w lamp, "stills," reverse. $174.50. 500w model, $123.50.

EASTMAN KODAK COMPANY, Rochester 4, N.Y.

Kodak
TRADEMARK

Hi-Fi Buyer's Guide:

FM Tuners

Hi-Fi and Electronics

By Hubert Luckett

IF YOU haven't listened to FM radio with one of the better modern tuners, you're in for a pleasant surprise. There's no better hi-fi to be had than live music broadcast over FM and picked up by a modern FM tuner.

The superiority of an FM broadcast is inherent in the nature of the transmission and the regulations governing it. With a good tuner, FM can give you:

- The full range of sound, from the lowest audible frequency to the highest.
- Wider dynamic range—the quietest to the loudest sound found in live music.
- Freedom from background noise, static, hiss or other interference.

Is there enough FM sound around to make investing in an FM tuner worthwhile? Definitely yes. More, it's on the upswing, with the boom in stereo injecting potent hormones in its bloodstream. Another, even heftier, stimulus will come when the new multiplex system takes over, as insiders are convinced it will. Today's stereo broadcasts are usually simultaneous FM-AM two-receiver affairs. But tomorrow's system, using multiplex, will let you hear *both* stereo sound channels with a single FM receiver.

Can you reap the rewards of FM with any old FM set? Not at all. Good FM reception needs a much more sophisticated electronic device than either an AM radio or a hi-fi amplifier. Skimpily designed and built, it will give you troubles. Like these:

- Correct tuning will be tricky.
- It will drift off station after tuning.
- It will be subject to local interfer-

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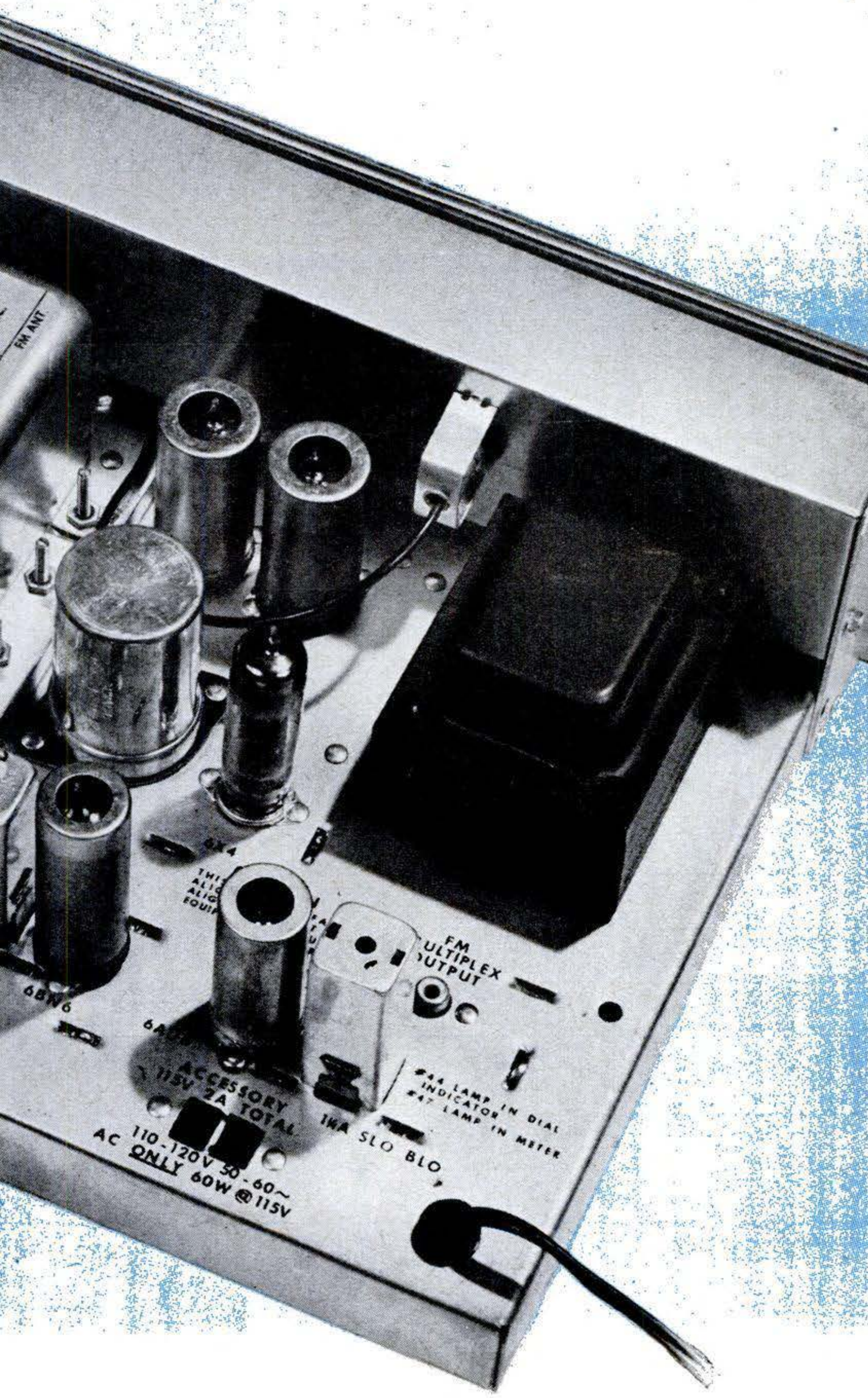
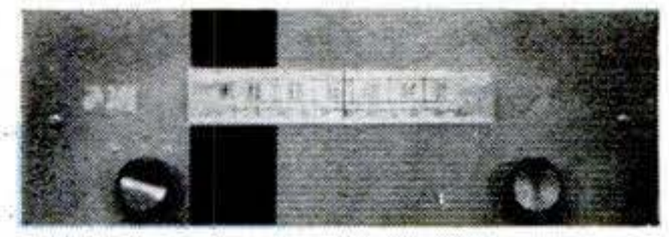
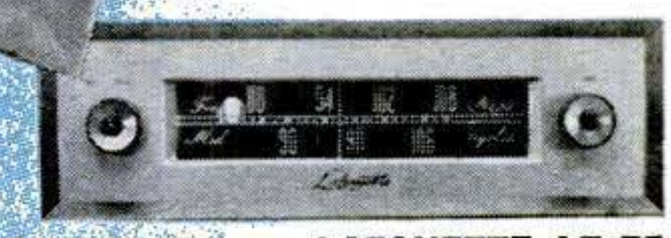


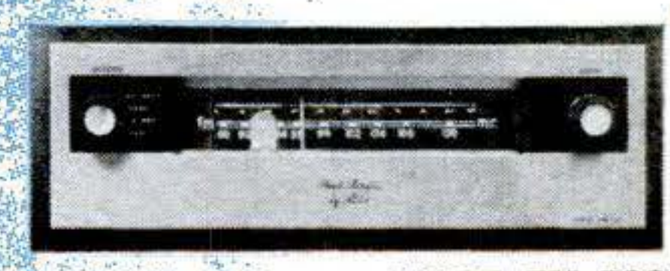

ALTEC 307A

BOGEN FM-51

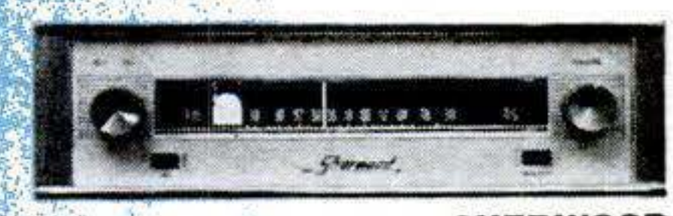
FISHER FM-90X

KNIGHT (ALLIED) KN-140


LAFAYETTE LT-75


PILOT FM-530

SCOTT 310B


SHERWOOD S-3000

ence from appliances and auto ignition.

- There will be excessive distortion.
- An annoying AC hum will come over.
- Closely spaced stations will interfere so that neither is received clearly.

One more word of caution: FM tuners are delicate instruments. Even the best might arrive in your living room with one or more of the above symptoms, due to rough handling in shipment. Check critically for these faults while your guarantee

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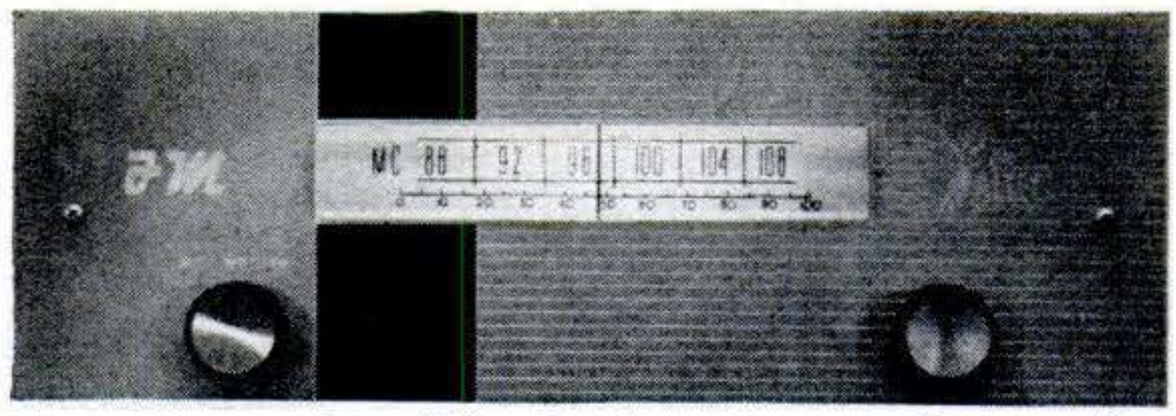
is still alive and the repairs are free.

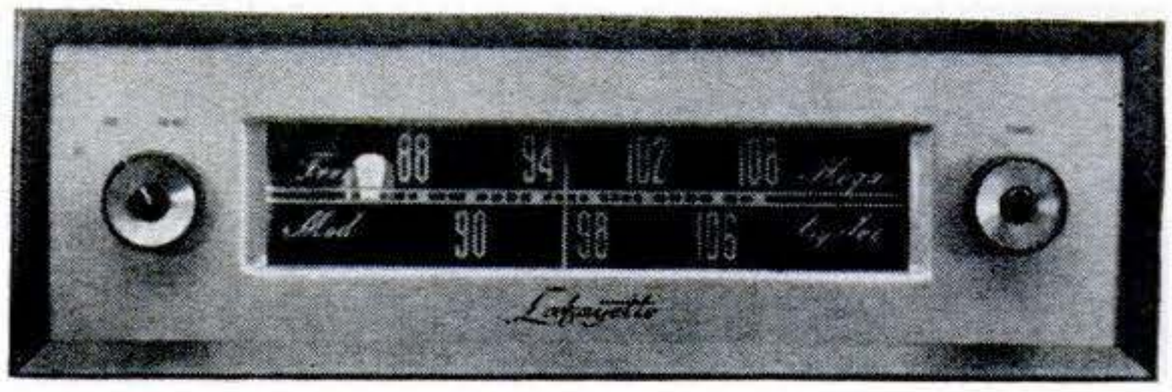
How much? For around $100 to $125 you can buy an FM-only tuner that will deliver performance available only in professional instruments a few years ago. You can pay more for added features, but this doesn't necessarily mean that the sound you hear will be noticeably better.

How to use the chart. The charted specs, given by the manufacturers in answer to our questionnaire, can give you clues about basic design. But the final answer is the performance in everyday use. We use-tested all the tuners available at the time—they are the ones shown in photos. Here is a point-by-point guide to help you read the chart:

Detector. Traditionally, the discriminator-limiter was the only choice for high-quality FM; ratio and other detectors were simply cheaper to make. Recently, designers have found otherwise: A ratio



ALTEC 307A. Squelch circuit automatically reduces noise between stations when the set is tuned. It has no tuning indicator, but AFC action was good and tuning was clean.



LAFAYETTE LT-75. Required careful tuning for minimum distortion. AFC action was only fairly effective. Has built-in antenna and switch-controlled AC outlet. Price includes cabinet.

FM Tuners: FACTS AND FIGURES

MANUFACTURER	MODEL	APPROX. PRICE	TYPE OF DETECTOR	NUMBER OF LIMITERS	NUMBER OF TUNED CIRCUITS IN I.F. AMPLIFIER	TYPE OF R.F. AMPLIFIER	BANDWIDTH (kc)		AUTO FREQUENCY CONTROL?	SENSITIVITY (microvolts for 20 db quieting)	
							I.F. Amp.	Detector		72 ohm	300 ohm
ALLIED RADIO	KN-140	$50	ratio	none	6	grounded grid	180	n.a.	yes	—	4
ALTEC LANSING	307A	$96	ratio	1	6	grounded grid	170	300	yes	—	2.5
BOGEN	FM-51	$105	ratio	1	8	grounded grid	180	350	yes	1	2
FISHER	FM-90X	$170	ratio	2	9	cascode	190	1,000	no	.5	—
HARMAN-KARDON	F-250	$130	discriminator	2	10	tetrode	260	600	yes	—	0.95
LAFAYETTE	LT-75	$50	discriminator	1	8	pentode	200	n.a.	yes	—	4
PILOT	FM-530	$90	ratio	1	6	pentode	200	n.a.	yes	—	3
	FM-660	$150	discriminator	2	9	cascode	200	1,000	no	—	1
H. H. SCOTT	311-C	$125	ratio	2	8	cascode	150	2,000	no	—	2
	310B	$175	ratio	3	10	cascode	150	2,000	no	1	2
SHERWOOD	S-3000	$100	discriminator	3	9	cascode	200	600	yes	—	0.95

n.a.: Information not available

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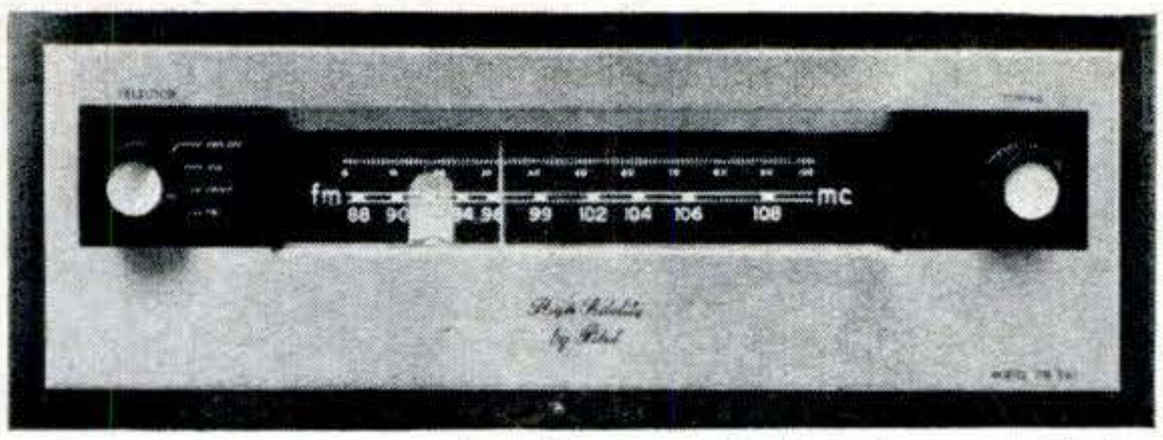
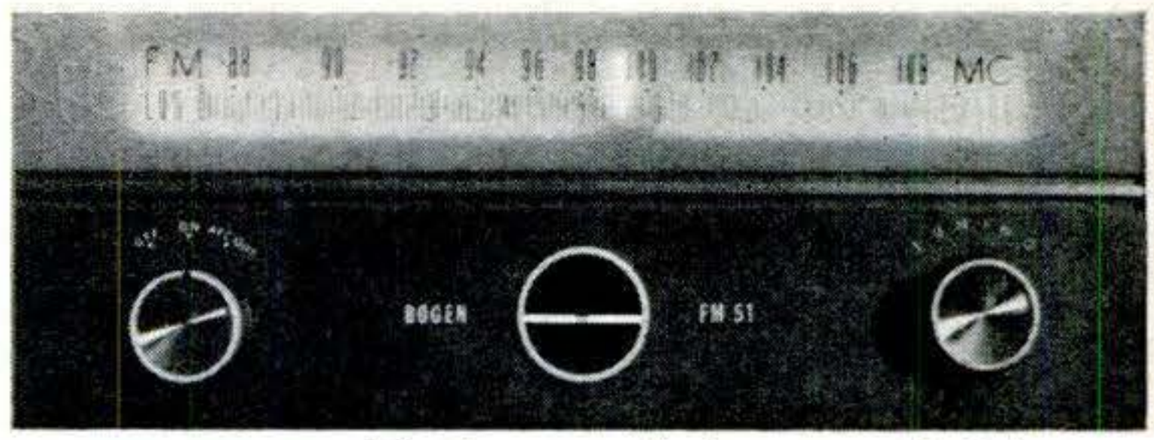
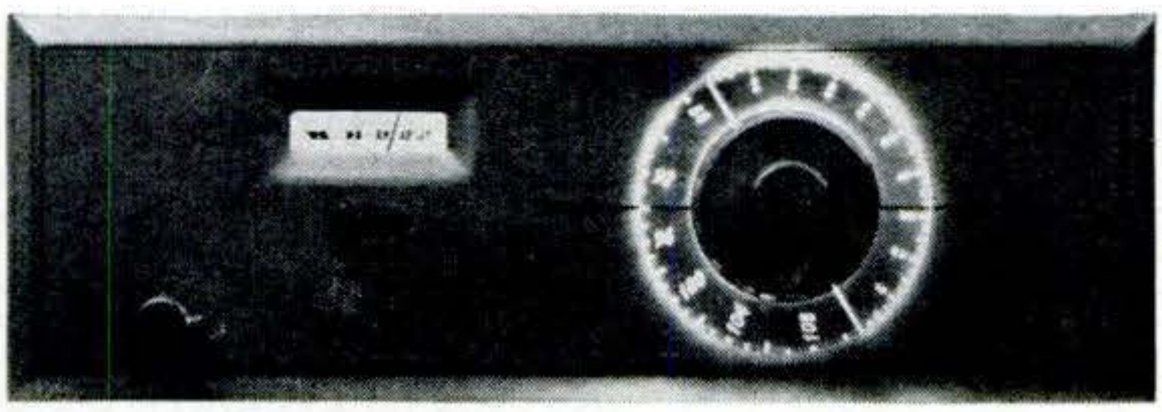


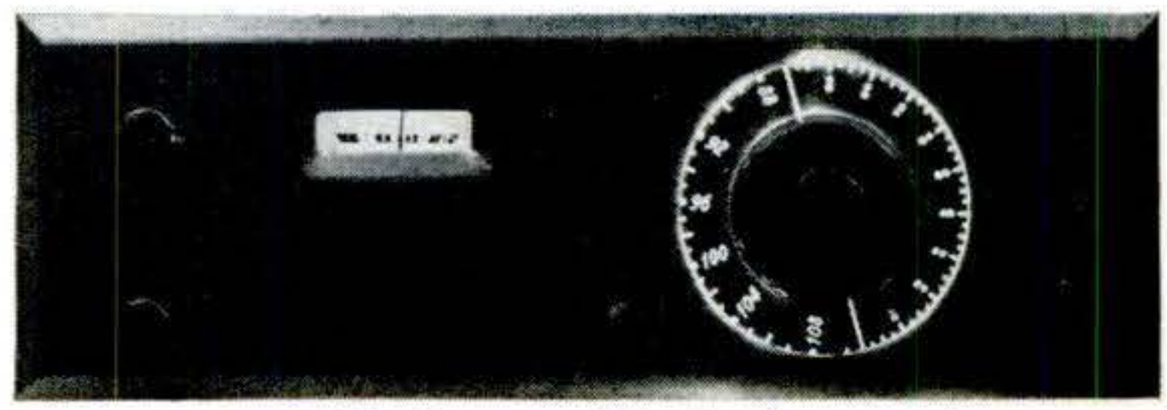
PILOT FM-530. Tuning-eye indication could be easier to interpret. AFC action was good. Tuning ease and accuracy were very good. Has built-in antenna and switch-controlled AC outlet.



BOGEN FM-51. Tuning eye brings two bright lines together for correct tuning indication. Easy tuning with good AFC action. Dial pointer is a projected light beam. Has built-in antenna.

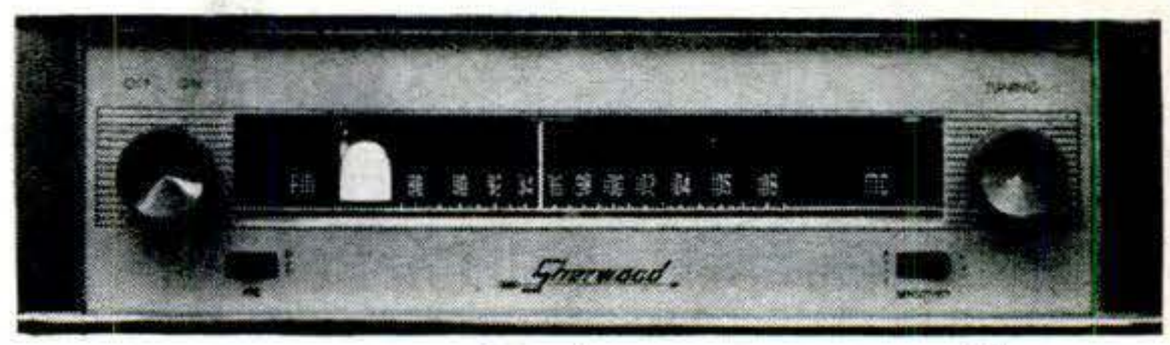


SCOTT 311-C. Meter gave precise indication of correct tuning. Circular dial provides either rapid or vernier adjustment. Level control on panel. Comes with a folded dipole antenna.

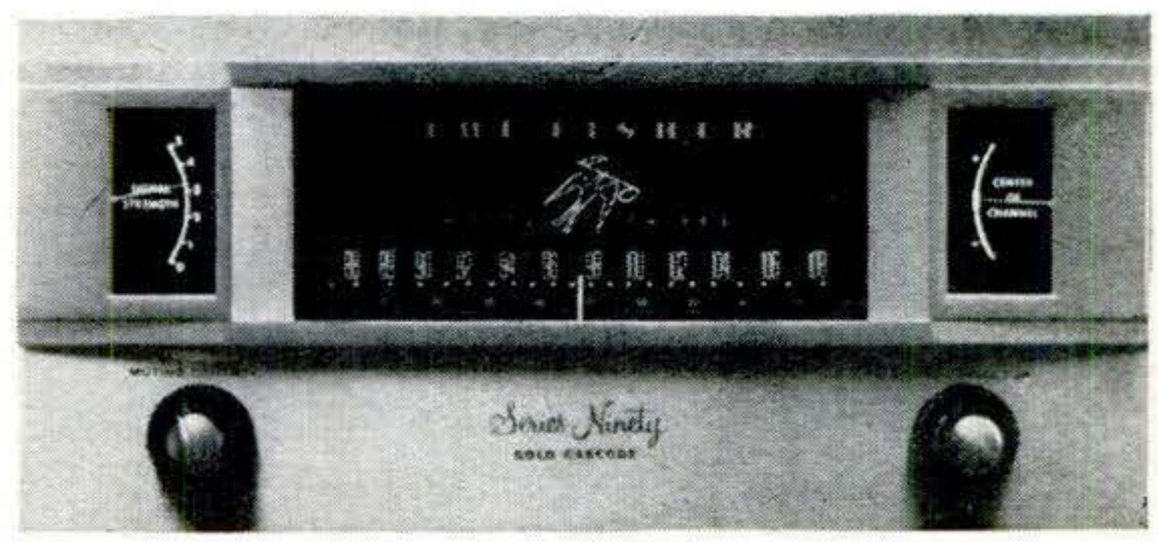


SCOTT 310B. Similar to 311-C plus an interstation noise suppressor controlled from front panel. Received weakest signal logged during test—70 miles away with an indoor antenna.

CONTROLS	TUNING-INDICATOR TYPE	NUMBER OF TUBES	NUMBER OF CRYSTAL DIODES	OUTPUTS
(1) FM-AFC, FM, off (2) tuning	none	5	0	2 high impedance
(1) tuning (2) FM-AFC, FM, off	none	4	3	1 cath. follower 1 multiplex
	tuning eye	8	2	1 high impedance 1 multiplex
(1) on-off, noise muting, (2) tuning (3) level (rear)	2 meters	9	4	2 cath. follower 1 multiplex
(1) tuning, (2) FM, FM-AFC, FM multiplex, off	tuning eye	10	0	2 cath. follower 1 multiplex
(1) tuning (2) FM-AFC, FM, off	tuning eye	7	0	2 high impedance 1 multiplex
(1) FM-AFC, FM, aux., off, (2) tuning (3) level (rear)	tuning eye	7	0	1 cath. follower
(1) on-off, (2) tuning, (3) muting, (4) level (rear)	meter	9	3	2 cath. follower 1 multiplex
(1) level, on-off (2) tuning: fine, coarse	meter	7	2	2 cath. follower 1 multiplex
(1) level control (2) noise suppressor, on-off, (3) tuning: fine, coarse	meter	10	2	2 cath. follower 1 multiplex
(1) on-off, (2) tuning (3) AFC on-off, (4) sensitivity: local, distant, (5) level (rear)	tuning eye	9	0	1 cath. follower 1 multiplex



SHERWOOD S-3000. Tuning eye opens widest for correct tuning—fairly easy to judge. Tuning ease, accuracy and AFC action were very good. Has local-distance switch and AC outlet.



FISHER FM-90X. Has variable interstation muting with front panel control. Two meters—signal strength and center of channel—gave excellent tuning indication. Folded dipole supplied.

• •

This is the second in a series of shopping stories on hi-fi components. In coming months, all links in the hi-fi chain will be covered—a different component each month. To help you make a wise choice, PS will give you the background information you need plus up-to-date facts on available equipment. Next month in POPULAR SCIENCE: Record Changers.

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detector, designed for quality and not low cost, and used with limiters, can equal or exceed the quality of a discriminator.

Limiters. These remove all traces of unwanted signals, static and other disturbances from the incoming radio wave. Ratio detectors have an inherent limiting action, so you can count one more effective limiter if the set has it.

I.F. amplifiers. The more tuned circuits in the I.F., the better its characteristics can be controlled. A precisely tailored I.F. pass band is essential for low distortion, rejecting interference, and separating adjacent stations.

Bandwidth. The FM carrier wave swings a maximum of 75 kilocycles either side of the center frequency. This total swing of 150 kilocycles must be accommodated by the I.F. and detector. Allowance for some possible drift and other considerations brings this figure up to 280 kc. (given by some authorities) for the theoretical overall bandwidth needed for best possible performance. In recent years the extremely wide-band detector coupled with a fairly narrow band I.F. has proved to have advantages.

AFC. Automatic frequency control was once thought to be an absolute essential for a good FM tuner. This electronic circuit automatically pulls in a station when the dial is turned to the vicinity of correct tuning. It also holds the signal in tune—correcting any tendency the set may have to drift. With wide-band detectors it is not needed—tuning is simple and unconfusing—and there is bandwidth to spare to take care of any slight drift.

Sensitivity. The weakest signal that will produce sound a specified amount louder than background noise is the measure of a set's ability to pull in distant stations. The smaller the number, the greater the sensitivity. These figures shouldn't be taken too literally. Our own practical tests showed only a very loose correlation between the numbers given and the relative effectiveness in receiving distant stations.

Outputs. Cathode-follower outputs let you use almost any length (up to 50 feet) of shielded cable to connect to your amplifier without suffering any loss of signal quality. With a high-impedance output, the leads must be kept short. A second output jack is a boon if you want to make tape recordings off the air. The multiplex output will feed an adapter for FM stereo when it becomes available.

Listening check. The only meaningful way to compare listening quality is to switch quickly from one source to the other—hear one while the memory of the other is still fresh. We switched only the tuners; antenna, amplifier and speakers were the same. Here's what we found:

Tuning. The meter indicators were generally more positive in indicating correct tuning than the tuning eyes. Of the several types of tuning eyes, the one on the Bogen gave the most unmistakable indication. Some of the sets were a little fussier to tune exactly than others. The Fisher and Scott were particularly easy. With the other sets, the cleanest sound was obtained when the station was first tuned accurately with the AFC off.

Drift. Not a problem with any of the tuners during long periods of use. The Lafayette showed some drift in warm-up, but stabilized after a few minutes.

Interference. The Bogen, Sherwood, Fisher and Scott tuners showed excellent ability to reject strong local interference from an unshielded ignition system.

Distortion. Among the tuners selling for around $100 and up there was no audible difference in distortion or frequency response when receiving a high-quality live broadcast from a local station.

Hum. Only the Lafayette and Altec tuners had enough hum to be noticeable during quiet passages when the program was played at fairly high volume.

Station separation. The Fisher and Scott 310B showed outstanding ability to separate closely spaced stations. The Sherwood, Pilot and Scott 311-C were almost as good. All of the tuners satisfactorily separated most of the 20-odd stations logged in this check.

Sensitivity. Any one of the tuners we checked has enough sensitivity for most locations. The Fisher, Scotts and Sherwood seem to have a slight edge for far fringe reception.

One last word: If you want to tap the wealth of hi-fi listening in the air—free for the tuning—without the annoyances that have often been found with FM, your tuner is no place to skimp. Probably more than with any other hi-fi component, your best buy in the long run is the best tuner you can afford. END

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A word to wise wives

AS SOON as you are able to get this issue of POPULAR SCIENCE away from your husband, we suggest that you leaf through the pages that follow, looking for checkmarks in pen or pencil.

Please recognize these as the mark of a gentleman, the Man of Your House. He is trying to help you answer a question that arises each year at this time—what to give him for Christmas.

It wouldn't surprise us at all if you found quite a few checkmarks. Turn almost any man loose in a collection of tools and shining hardware and you'll see an I'd-like-that gleam come to his eyes. He responds to tools in exactly the way you do to the sparkle in a jewelry store.

Statistically speaking, we know a lot about the Christmas wishes of that man of yours. Early this year we asked a representative group of POPULAR SCIENCE readers what they wanted last Christmas, what they received, what they want this year.

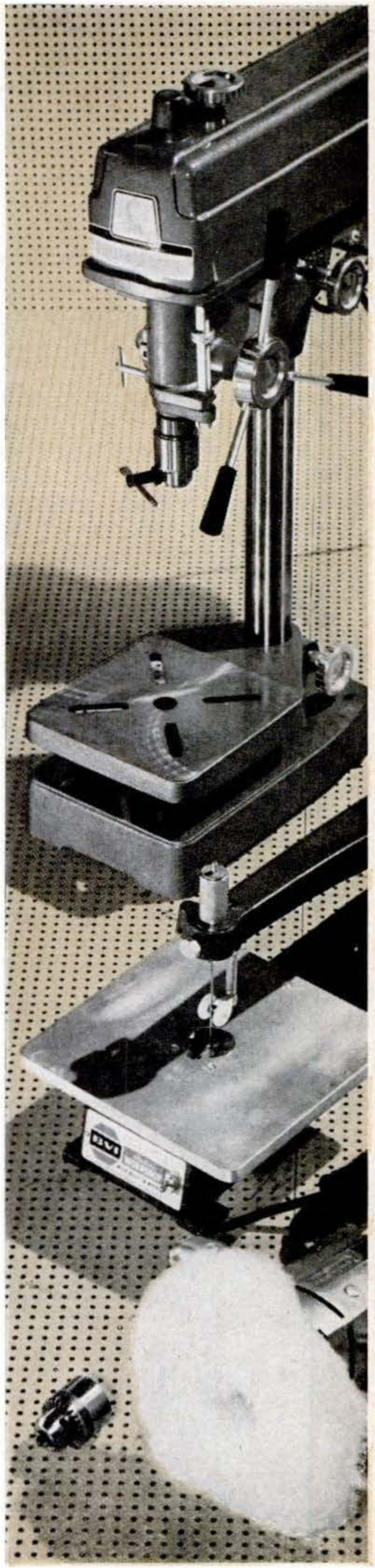
They received a great variety of items—socks, ties, hi-fi sets, records, radios, musical instruments, photo equipment, guns, razors, fountain pens, books, and on through a list almost without limit. But one statistic stood out:

A third of the men said the Christmas present they would *most* like to get was some type of tool —usually a power tool.

If you run through the following pages and find no checkmarks, don't let that deter you. Maybe That Man hasn't yet read this page. (We'd hate to suggest he's so inconsiderate as not to help you.)

You'll understand of course that what you'll see on the following pages is just a part of the tools you'll find in his favorite tool-selling emporium. For space reasons we couldn't begin to show you all the wares in a hardware store. We had to restrict ourselves to items that are new in some way or another. But somewhere among what you'll see here and on the counters and display boards of your stores you are bound to spot the perfect gift.

The Editors of POPULAR SCIENCE



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Stationary or Portable?

Which Tools Should

By R. J. De Cristoforo

YOU can't beat a table saw or one of the newer radial arms so long as you can conveniently bring the work to the table surface. But suppose you're out on the job and must trim a set of roof rafters?

You then have two choices. You can fall back on your old arm-driven handsaw. Or you can bring the mountain to Mohammed by wrapping the guts of a shop power saw in a portable package and carrying it to the job.

That's why portable power tools were born.

The division of labor between a shop-imprisoned power tool and its portable counterpart isn't always so clearly defined, however, and those of us who are economy-minded sometimes come up against a sticky problem: Which type to buy—or perhaps which type to buy *first?*

How to choose. Your best answer can be found by analyzing the kind of jobs you'll do the *most*. Does a coffee table or a hi-fi cabinet typify the projects you'll be making? Then a stationary saw is your basic tool. Is a side porch or a new garage more indicative of your interest? A portable saw will be more useful.

This doesn't mean you couldn't do eith-

Which type of tool user are you?

AN HONEST answer to this question right now may save you a lot of money over the years and immeasurably increase the satisfaction you derive from the use of tools.

For the wise choice of tools comes down to one simple axiom: The tools you ought to buy depend on the jobs you'll use them for.

The jobs you'll do will automatically put you into one (or more) of the five categories of tool users listed on these two pages. Under each type you'll find the tools most commonly used for the kind of work involved—listed in the order a smart user might acquire them.

So, first of all decide what type (or types) of tool user you are. Then refer to the table on the following two pages to see the range of jobs you could do with the tools in each category.

Big Project Man? (A)

That's you—if your plans include jobs like finishing an attic, building a carport, adding a room. The tools:

STATIONARY	PORTABLE
2—radial-arm saw	1—cut-off saw 3—½" drill 4—saber saw

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You Buy First?

er job with one tool or the other. It does mean you'll handle the bulk of the necessary cuts more conveniently with a particular one. Power tools are funny. Each is important, but in the overall plan there isn't a single type you couldn't do without; and, in some way, there isn't a single one that won't help you do a job better, faster or more conveniently.

Any list of tools in order of importance must necessarily be a generalization. A tool that enables you to size wood to correct length and width is the logical first choice. But even this first decision is not so simple. Tools are no longer designed to do just one thing. Only by separating projects and related operations—thereby automatically creating categories of tool users—can you be completely objective in making your decisions.

What's the goal? We can assume one thing: That you, like all other craftsmen, started out by using hand tools. Basically, you want to buy power tools, stationary or portable, because they enable you to do hand-tool jobs faster, more accurately, and with less effort. But you can never get away from hand tools entirely. Any power tool has its limitations and any selection of a group of power tools is a compromise. The wise choice is one that saves you the most time and effort in the particular kind

Home Maintainer? (B)

Put yourself here if you take care of repairs and make plain built-ins—but would rather go fishing. The tools:

STATIONARY	PORTABLE
1—table saw	2—¼" drill 3—belt sander

Old-Time Craftsman? (C)

Here you are if you like to make reproductions of early furniture, including intricate joints. The tools:

STATIONARY	PORTABLE
1—table saw 2—drill press 4—disk-belt sander 5—lathe 6—jigsaw 9—jointer 10—bandsaw	3—pad sander 7—router 8—¼" drill 11—belt sander

Modern Craftsman? (D)

Do you make modern furniture and built-ins, all with the simplicity of contemporary style? The tools:

STATIONARY	PORTABLE
1—table saw 2—drill press 4—disk-belt sander 8—jointer	3—pad sander 5—saber saw 6—¼" drill 7—belt sander 9—router

Pure Hobbyist? (E)

Type yourself this way if tools are for fun only, for making lamp bases, inlaid trays, wood puzzles. The tools:

STATIONARY	PORTABLE
1—jigsaw 2—lathe 5—drill press 6—disk-belt sander	3—pad sander 4—¼" drill

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How Stationary and Portable

39 common jobs

JOB	STATIONARY TOOLS							
	TABLE SAW	JIGSAW	BANDSAW	RADIAL-ARM SAW	JOINTER	DISK-BELT SANDER	LATHE	DRILL PRESS
RIPPING	X B C D	X E	X C	X A				
CROSSCUTTING	X B C D	X E	X C	X A				
MOLDING	⊠ C			⊠				⊠ C D
DADOING	⊠ B C D			⊠				
BEVELING	X C D			X	X C D			
MITERING	X B C D			X A				
COMPOUND MITERING	X C D			X A				
CROSSCUT END OF 18′ 2x4				X A				
CUT 2″ OFF 4′x8′ PANEL								
DUPLICATE PARTS FOR 6 DRAWERS	X B C D			X				
TRIM OFF INSTALLED ROOF EDGE								
CUT OPENING IN WALL								
CUT CURVES		X C E	X C					
CUT FRETWORK		X C E						
NOTCHING ERECTED STUDS								
PIERCING		X C E						
CUT PLUMBING HOLES								
SHAPE VALANCE OR CORNICE		X	X					
PLANE AN EDGE	⊠				X C D			⊠
PLANE A SURFACE					X C D			
RABBET	X B C D			X	X C D			⊠
CHAMFER	X C D			X	X C D			
MORTISE FOR DOOR HINGE								
SAND A LARGE PANEL								
SAND AN ASSEMBLED PROJECT								
SAND CURVED EDGES (INSIDE)				⊠		X C D E		⊠ C D E
SAND PARTS FOR ACCURATE SIZE	⊠			⊠		X C D E		
RESURFACE A BUILT-IN								
DRILL IN WOOD				⊠				X C D E
DRILL IN METAL								X E
ROUT A GROOVE				⊠				⊠ C D
MAKE A MORTISE				⊠				⊠ C D
SHAPE A BOWL							X C E	
MAKE ROUND LEGS							X C	
MAKE TAPERED LEGS (SQUARE)	X C D		X C	X	X C D			
MAKE CIRCULAR TRAY							X E	
METAL SPINNING							X	
TURN A LAMP BASE							X C E	
MAKE DOVETAILED JOINTS				⊠				⊠ C D E

SYMBOLS:
A—Big-Project Man
B—Home Maintainer
C—Old-Time Craftsman
D—Modern Craftsman
E—Pure Hobbyist
X—Standard equipment
⊠—With accessories

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Power Tools Compare

and the tools you can use to do them best

	PORTABLE TOOLS						
	CUT-OFF SAW	SABER SAW	ROUTER	1/4" DRILL	1/2" DRILL	BELT SANDER	PAD SANDER
	X A	X		☒			
	X A	X		☒			
			X C D				
			X				
	X		X				
	X	X		☒			
	X						
	X A	X					
	X A	X		☒			
	X A						
	X A	X		☒			
		X A D	X	☒ B			
		X A		☒			
		X A D	X				
		X A					
		X D	X	☒			
			☒				
			X				
			X				
			X C D				
				☒		X B C D	X
				☒ B		X	X C D E
						X	X C D E
				☒		X B D	
				X B C D E	X A		
				X B C D	X A		
			X C D				
			X C D				
			☒ C D				

of work you may want to do.

These considerations apply to all tools, including the big bombs that explode occasionally on the scene to hog the picture—like the multipurpose tool a decade back, the portable cut-off saw, the multipurpose radial arm, the portable jigsaw.

The portables. In recent years, portables have made the most noise. Reason: Manufacturers always relate tool use to its prevalent need. Folks have been building and remodeling houses, tearing down old walls or putting up new ones, adding rooms and carports, tackling all sorts of jobs that require power *away* from the workshop.

There will be times and jobs when the home owner who got his portable for on-location improvement chores will long for the precision and ease of a stationary tool. He can draw comfort from the plight of the man who loves woodworking, but eventually gets to the assembly stage with his projects where he can no longer hoist them onto his tool table—and yearns for a portable.

Or take the case of a table-saw owner who is paneling a room. He needs to take an inch off a 4′-by-8′ sheet of plywood. He *could* do it on a table saw but it wouldn't be easy. With a portable, he could whisk it off in seconds, right on the job.

You wouldn't buy a portable saw just for a single job like this, but by the time you had sweated a couple of plywood panels through a table saw, you'd be dropping hints for your next birthday.

If you do graduate from one design to another, it isn't that either offers a preparatory course, but that your tool wisdom accumulates regard-

[*Continued on page 218*]

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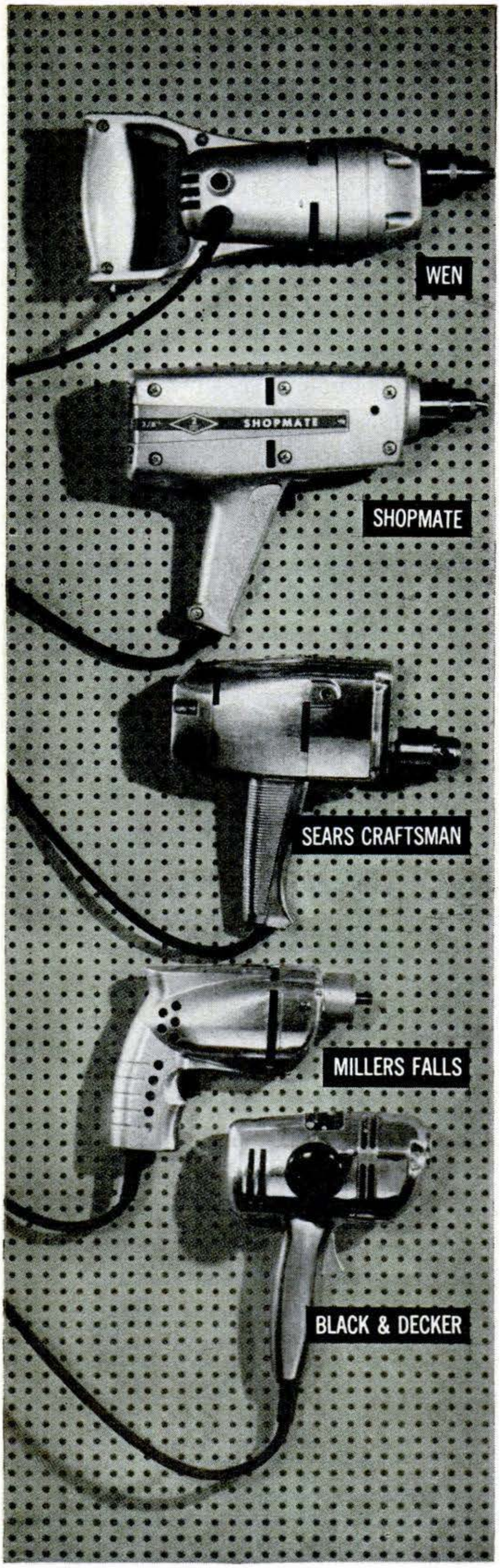
All About

They have to do lots more than drill holes—and the new ones can. Here's how to pick yours



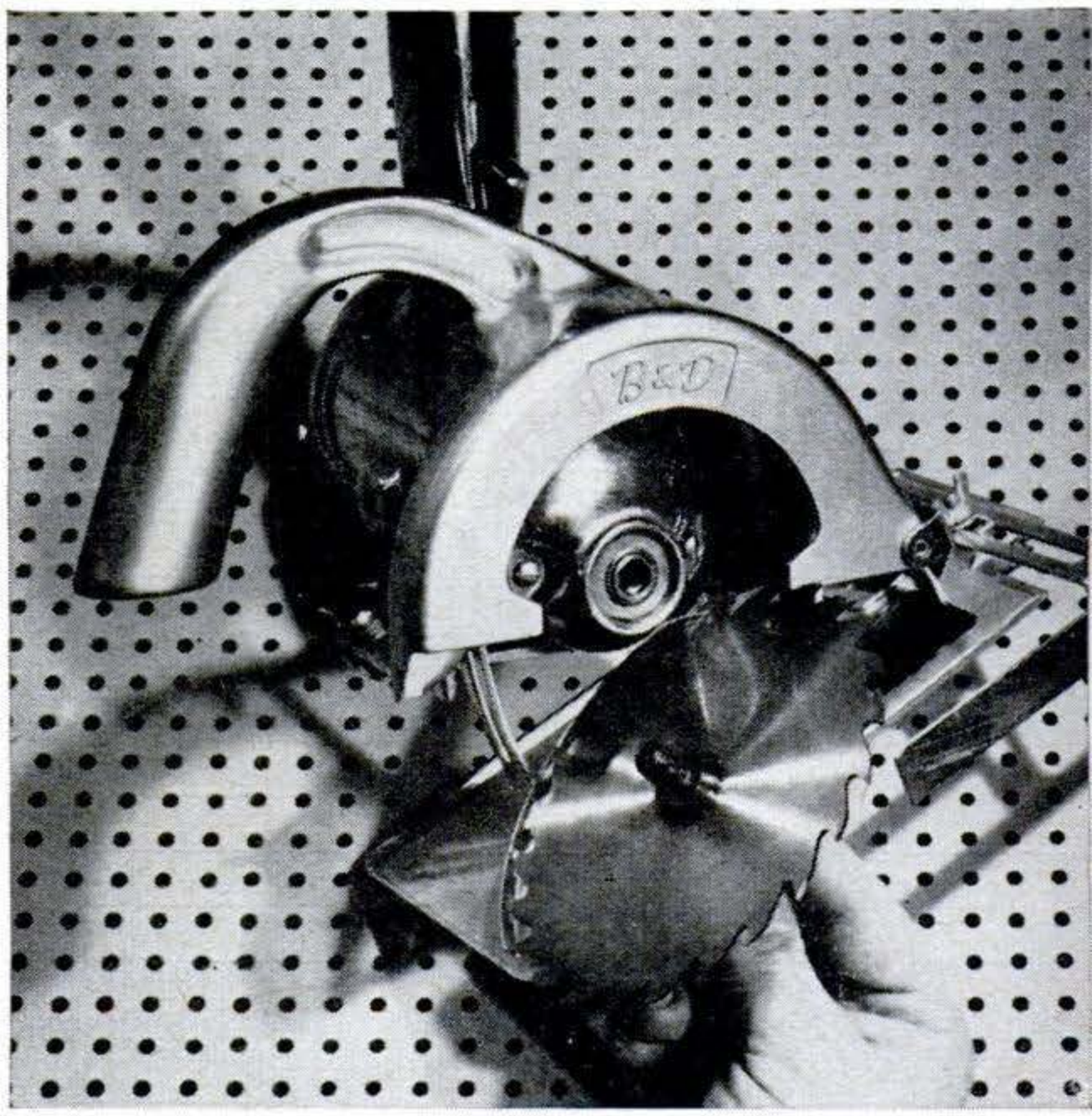
EXCITING new things are happening to the home owner's power-operated right arm—the electric drill. Today hardware counters display a dozen different varieties, all looking pretty much alike but carrying different names and prices. They *are* different, too. And the difference is important when you shop for one.

The reason is that the 32,000,000 people who run power drills insist on using them for practically everything but drilling. What you're going to use it for most determines which type will be best for you.

Here's a quick tour through the maze of types:

The standard quarter-incher with a geared chuck is the most popular com-

NEW SHAPES IN DRILLS: Top three models at left offer two speeds for fast and slow work. Two multipurpose drivers at lower left take either drill chucks or accessories that screw directly to shaft, as on Black & Decker below.



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Buying Electric Drills

promise. New models are more powerful. They will drill small holes easily, bigger ones fairly well. And they can also do acceptable jobs as a circular, jig, or hole saw; a rotary, belt, table or orbital sander; a wire brush, knife sharpener, planer, waxer, polisher and buffer.

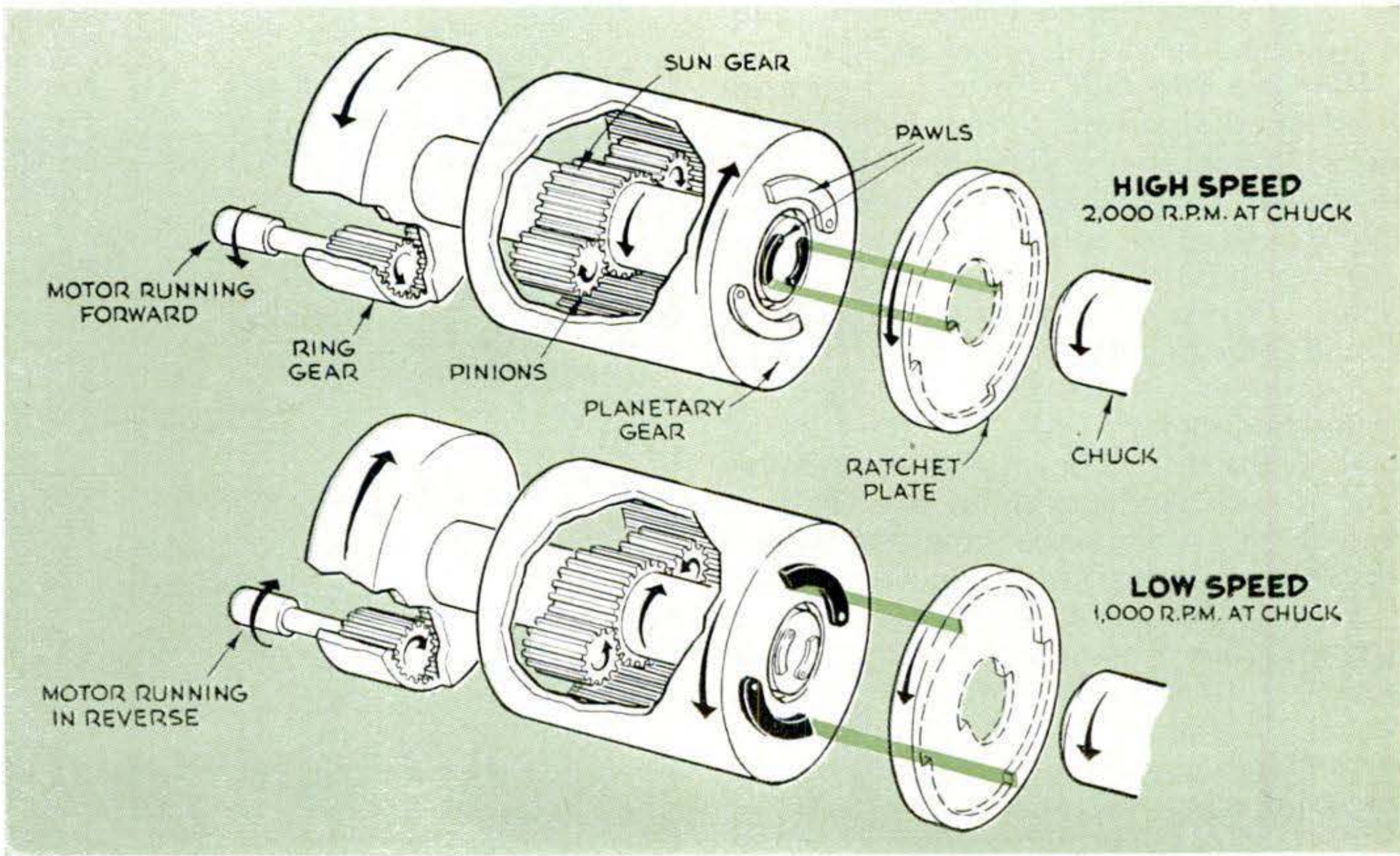
- The two-speed drill—new this year under at least four brand names—shifts gears to accommodate r.p.m. and torque to the job at hand. One type switches electrically through a planetary-gear system; the other type has two separate power-take-off spindles. You use the low-speed, high-torque output for big-hole cutting, polishing and waxing; the high-speed, low-torque output for small holes, sawing and sanding. These machines have ⅜-inch chucks, but are not the same as standard ⅜-inch drills (see below).
- The conventional ⅜-inch drill offers low speed with high torque. It is fine for the larger twist drills, for carbide-tipped masonry drills and for driving screws.
- Drivers, several new this year, are electric motors with handles. They are designed specifically to power attachments (including drill chucks), which either screw directly on the motor spindle or fit into a hex socket. They range all over the lot in speed, one model turning a sedate 275 r.p.m. (ideal for driving screws), another spinning faster than 3,000 r.p.m. (good for a saw accessory).

First choice. There's no debate over the choice for the average home owner, faced with a limited budget and occasional jobs of the widest variety from drilling to polishing to paint-mixing: It's the quarter-incher, which does the middle-range, light jobs very well, yet can manage any of the others.

But if you need great versatility very often—one week drilling a concrete wall (low speed), the next week wire-brushing paint off (high speed)—take a close look at the dual-speed ⅜-inchers. Being adaptable, they will work their way through special jobs faster and easier.

Some people use their drills only to

HOW A NEW TWO-SPEEDER WORKS: Flipping a switch automatically changes speeds by *reversing the motor* on this Shopmate drill. At high speed, motor turns forward, driving chuck in same direction through pawls on sun gear. At low speed, motor turns backward, but drives planetary gear forward at half speed. Pawls on the planetary gear then drive the chuck forward at half speed while the sun-gear pawls can no longer engage the ratchet plate.



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Facts About ¼" Drills

power attachments. If your work is like that—if you rarely drill holes, but do a lot of sawing, for example—then the driver type of drill may serve you best. Choose the one that matches the requirements of your favorite accessories: A circular saw cuts better at high speed and calls for a high-speed driver; running in screws or boring big holes calls for a low-speed machine.

Other drills are more specialized. The standard ⅜-incher stands out when there are a lot of holes to be made in steel. And for steady hard drilling, don't overlook the professional's hefty half-inch drill, which now has been prettied up and lowered in price for the handyman.

Which one? The rule is simple: Buy the most powerful drill that fits your purse and purpose.

An underpowered drill makes easy jobs tedious. Any old drill will make holes—if the holes aren't too big. But without enough power, it will drive attachments too leisurely for them to be useful, and in sustained service may get too hot.

How can you tell? Speed and current listed on the nameplate clue you to the tool's capabilities. Theoretically, the power, in watts, that an electric motor delivers at rated speed is voltage times current (multiplied, too, by the power factor, with AC). A larger current rating should indicate more power.

But there's a hitch: The current draw varies enormously with the mechanical load on the drill. The crucial point is the load it can handle without overheating. And there are no agreed-upon standards for a "normal" load with home drills.

There is nothing to keep an unscrupulous supplier from upping a nameplate current rating to three or four times a realistic value. However, the reputable manufacturers adhere to reasonable engineering standards on this score. While a few tenths of an ampere may be insig-

MAKE AND MODEL		APPROX. RETAIL PRICE	LENGTH (in.)	WEIGHT (lb.)
ALBERTSON (Sioux)	1885	$29	7¾	3¼
	1475	$30	7½	3¼
	1485	$48	8	3½
	1495	$48	8⅜	3½
	1480	$50	11¼	5¼
	1525	$59	12	7¼
BLACK & DECKER	U-100	$19	7⅝	3
	U-3	$25	8¼	3¼
	U-500	$30	7½	3¼
CUMMINS	304	$25	8⅜	3
	305	$30	8⅜	3½
	306	$35	8⅜	3½
DORMEYER	5-2400	$25	8¼	4
	5-2103	$25	8½	4
	5-2202	$30	8½	4
McGRAW-EDISON (Manning-Bowman)	958	$18	7¾	3¼
	1257	$22	8¼	3¾
	753	$27	7½	4
MILLERS FALLS	1114A	$23	8⅜	3
	1134A	$30	8⅜	3
MILWAUKEE	250	$35	8½	3¼
	S-114	$40	10¾	5¼
MONTGOMERY-WARD (Powr-Kraft)	9300	$15	7¾	2¾
	9301	$23	7¼	3¼
	9303	$35	7⅞	4¼
PET	1440	$25	7¼	3¼
PINCOR	P-120	$24	8¾	3¼
PORTER-CABLE	161	$27	7½	2¾
	107A	$34	8¼	3½
	515	$50	7¼	3¾
REMINGTON	140	$20	8	3
	149B	$25	8	3
	149DL	$30	8	3
SEARS, ROEBUCK (Craftsman)	315.7640	$12	8¾	3
	315.7910	$15	10⅝	4
	315.7711	$23	10⅞	3½
	315.7970	$35	9	3½
SHOPMATE	740BGN	$20	7¾	2¾
SKIL	503	$19	8¾	3½
	549	$25	8¾	3½
SPEEDWAY (Thor)	20	$18	9	4
STANLEY	H-131	$25	8½	3¼
	H-1132	$30	8½	3¼
	H-133	$35	8½	3½
	138	$40	8½	3½
	235	$45	8⅛	3½
SUNBEAM	70	$26	7¾	3
	177	$43	7¾	3
WIZARD (Western Auto)	5H1394	$13	9½	3
	5H1350	$18	7¾	3
	5H1373	$26	11	3¼

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POWER CORD		CHUCK SPEED (r.p.m.)		CURRENT DRAW (amperes)				POWER (watts)		GEARS		BEARINGS			TYPE OF U. L. LISTING
													Type		
Length (ft.)	Grounded Plug	Rated	At Max. Power	Rated	At No Load	At Max. Power	Locked Armature (stall)	Mechanical Output at Max. Power	Electrical Input at Max. Power	No. of Stages	Overall Reduction	Number	Thrust	Other	
7	yes	2,250	1,000	1.3	.9	2.5	4.6	70	270	1	7	5	ball	sleeve	domestic
7	yes	2,250	1,050	1.5	.9	2.1	4.9	83	234	1	7	5	ball	sleeve	industrial
10	yes	1,650	650	1.4	.5	3.1	5.5	103	295	2	12	5	ball	1 needle 3 ball	industrial
10	yes	1,650	740	1.4	.5	2.7	5.5	110	285	2	12	5	ball	1 needle 3 ball	industrial
10	yes	1,600	830	2.0	1.6	3.6	6.0	102	372	2	8.7	6	ball	4 sleeve 1 ball	industrial
10	yes	1,650	640	4.5	2.1	6.2	12.0	271	600	2	10.7	6	ball	2 ball 3 needle	industrial
6	no	2,000	770	2.0	.8	3.0	5.6	100	325	1	8.5	5	ball	sleeve	domestic
6	no	2,250	930	2.5	1.1	4.2	8.2	130	440	1	8.5	5	ball	sleeve	domestic
6	no	3,000	1,200	2.8	1.1	4.7	10.8	190	500	1	8.5	5	ball	sleeve	domestic
6½	no	1,800	740	1.9	.9	2.9	5.2	100	306	2	10.54	5	ball	sleeve	domestic
6½	no	1,800	985	1.9	.9	2.7	6.0	110	280	2	10.54	5	ball	sleeve	domestic
8	yes	1,800	740	2.0	.8	2.7	5.8	109	287	2	10.54	5	ball	3 sleeve 1 ball	industrial
7	no	2,200	840	2.6	1.2	3.4	6.5	120	355	1	10	5	ball	sleeve	domestic
7	no	1,800	840	1.9	1.1	3.0	6.4	126	330	2	12.18	6	ball	sleeve	domestic
7	no	1,800	800	2.0	1.0	3.3	6.5	133	325	2	12.18	6	ball	4 sleeve 1 ball	domestic
6	no	1,850	800	2.0	1.2	3.8	8.0	180	385	1	11.5	4	ball	sleeve	domestic
6	no	2,400	750	2.5	1.2	5.3	11.0	280	600	1	10	4	ball	sleeve	domestic
6	no	2,100	690	2.2	.9	4.1	8.5	130	410	1	10	4	ball	sleeve	domestic
6	no	2,250	850	2.7	1.4	4.5	8.8	140	480	1	10.8	4	ball	sleeve	domestic
7	yes	2,250	945	2.7	1.3	4.6	9.0	185	460	1	10.8	4	ball	1 sleeve 2 ball	industrial
7	yes	2,000	1,000	2.5	1.0	3.5	5.1	177	430	1	9	4	ball	ball	industrial
8	yes	1,900	870	3.4	1.6	5.6	11.6	247	570	1	9	4	ball	1 needle 2 ball	industrial
6	no	2,000	900	2.0	1.0	2.4	7.5	90	266	2	16	4	sleeve	sleeve	domestic
10	yes	1,800	1,200	2.4	1.1	3.5	4.5	172	394	2	10.64	4	needle	1 ball 2 sleeve	industrial
10	yes	1,800	925	3.0	1.3	4.0	10.5	208	416	2	10.25	6	ball	3 needle 2 ball	industrial
6	no	1,800	1,200	2.4	1.1	3.5	4.5	172	394	2	10.64	4	ball	sleeve	domestic
6	no	1,600	500	2.0	1.1	3.6	6.6	137	392	3	16.8	3	sleeve	sleeve	domestic
7	yes	2,450	960	1.8	1.0	3.5	7.0	125	366	1	8.2	4	ball	sleeve	domestic
7	yes	2,000	820	2.5	1.5	5.3	10.0	156	552	2	10.3	6	ball	sleeve	industrial
7	yes	1,800	750	3.0	2.1	6.3	13.0	267	748	2	13.7	6	ball	ball	industrial
7	no	2,500	1,000	2.5	1.3	4.5	8.0	150	480	1	8.38	4	washer	sleeve	domestic
7	yes	2,500	1,000	2.5	1.3	4.5	8.0	150	480	1	8.38	4	washer	ball sleeve	domestic
7	yes	2,500	1,000	2.7	1.3	4.5	8.0	150	480	1	8.38	4	washer	ball sleeve	domestic
6	no	2,250	1,130	1.6	1.2	3.1	5.5	100	340	1	8.5	3	ball	sleeve	domestic
6	no	2,250	1,130	1.6	1.0	2.9	5.5	100	317	1	8.5	4	nylon	sleeve	domestic
10¼	yes	1,900	1,000	2.0	1.6	3.8	5.1	150	500	2	12	4	ball	1 sleeve 1 needle 1 ball	industrial
10¼	yes	1,800	680	3.0	1.4	5.7	10.9	289	608	2	14.9	6	ball	1 needle 4 ball	industrial
6	no	2,000	900	2.5	1.0	2.4	7.5	90	n.a.	2	16	4	sleeve	sleeve	domestic
7	no	2,500	1,050	2.5	1.1	4.4	10.0	150	355	1	8.5	4	ball	sleeve	domestic
7	yes	2,500	1,050	2.5	1.1	4.4	10.0	150	355	1	8.5	4	ball	sleeve	industrial
6	no	2,400	1,100	2.5	1.7	4.3	7.5	165	440	1	8.4	4	ball	sleeve	domestic
6	no	2,500	1,000	3.0	1.0	3.4	7.6	130	400	1	8.29	4	sleeve	sleeve	domestic
6	yes	2,500	1,000	2.2	1.0	3.4	7.6	130	400	1	8.29	4	sleeve	sleeve	industrial
6	yes	2,000	800	2.5	1.0	4.0	8.2	180	450	2	11.2	6	needle	3 sleeve 2 ball	industrial
8	yes	2,000	800	2.5	1.0	4.0	8.2	180	450	2	11.2	6	ball	2 ball 3 needle	industrial
8	yes	2,000	700	2.7	1.2	4.2	9.0	200	450	2	14.86	6	ball	4 ball 1 needle	industrial
7	no	2,200	900	1.8	.9	2.2	4.0	87	230	1	7.875	5	ball	sleeve	domestic
15	yes	2,600	1,100	2.2	1.2	3.0	4.6	115	300	1	7.875	5	ball	2 sleeve 2 needle	industrial
6	no	1,500	530	1.5	.8	2.6	4.2	98	280	1	14.8	3	sleeve	sleeve	domestic
6	no	2,000	700	2.6	1.0	2.6	7.5	n.a.	n.a.	2	16	4	sleeve	sleeve	domestic
6	no	1,800	800	2.2	1.4	3.5	9.4	125	400	2	13.38	7	ball	sleeve	domestic

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Facts About 3/8" Drills

nificant, you are fairly safe in assuming that one of their drills rated at three amps will deliver more power than one rated at two amps, if the drills have comparable gears and bearings and are listed for the same service.

What current? The chart lists four different current draws for each drill. Here's why.

At no load, the current is minimum. This represents the energy required to overcome electrical losses and friction of moving parts when no work is being done.

Current goes up with the load. When loaded sufficiently to cause rated current to flow, the drill should operate a long time without overheating.

As the load increases further, more current flows and more power develops to a point at which maximum power is reached. At maximum power, the drill overheats quickly.

Further increase in load causes more current to flow, but power output drops even though the twisting force (torque) continues to rise.

Finally, you can add enough load to stall the drill. The power output drops to zero while the torque and current reach maximums. This will burn out the motor in short order.

The chart gives manufacturers' measurements of current at these significant points. Taken together they give a fairly complete picture of the electrical performance of a drill motor. Since they were made in different labs, the figures may not be exactly comparable among different makes, but within any particular line they give you a pretty good idea of one reason why one 1/4-inch drill may sell for $15 while another that looks practically the same costs $35.

[Continued on page 222]

MAKE AND MODEL		APPROX. RETAIL PRICE	LENGTH (in.)	WEIGHT (lb.)
ALBERTSON (Sioux)	1517	$71	14	11
BLACK & DECKER	U-15	$37	8	3 1/4
CUMMINS	318	$40	9	3 3/4
McGRAW-EDISON (Manning-Bowman)	158	$30	9	4
MILLERS FALLS	2838B	$35	9 1/8	3 1/4
	1888	$40	9 5/8	5
MONTGOMERY-WARD (Powr-Kraft)	9305	$28	7 1/4	3 1/4
	9306	$32	n.a.	7 1/2
PET	1438	$28	7 1/4	3 1/4
PORTER-CABLE	149	$40	9	3 1/2
REMINGTON	389	$38	8	5
SEARS, ROEBUCK (Craftsman)	315.7850	$28	9 3/8	4 1/4
	315.27760	$30	6 1/2	3 1/2
SHOPMATE	748B	$27	7 3/4	2 3/4
	SD-382	$33	n.a.	7 1/2
SKIL	560	$37	9 3/4	3 1/2
SPEEDWAY (Thor)	30	$25	8 1/2	4 1/2
STANLEY	H-136	$40	8 3/4	3 3/4
	139	$45	8 3/4	3 3/4
WEN	808	$30	12 1/4	4 1/2
WIZARD (Western Auto)	5H1399	$25	7 7/8	3

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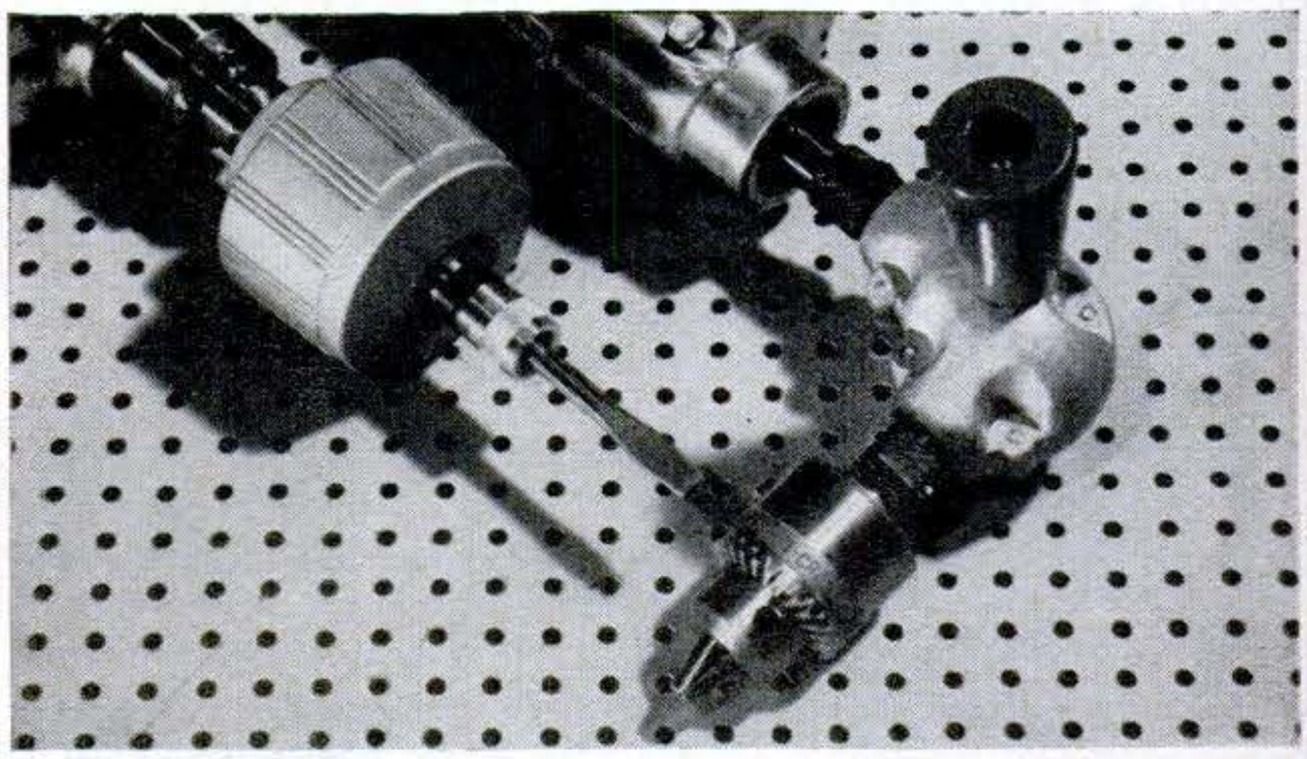

NEW DRILL ACCESSORIES are on the way, too. Versamate, at left, is low-cost ($9.95) version of Supreme's speed reducer for driving screws and nuts. Arco's two-speed angle drive, at right, has extra side handle for steady two-hand grip, takes a drill chuck or a polishing head.

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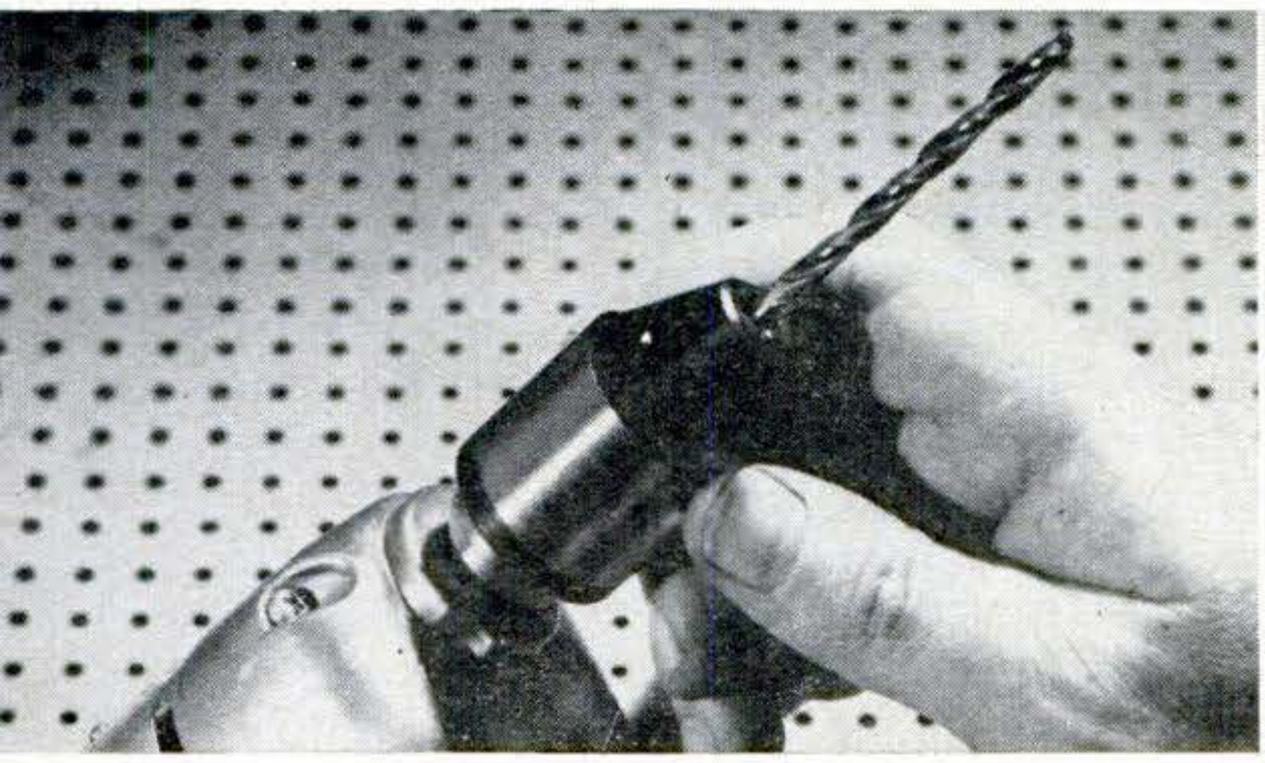
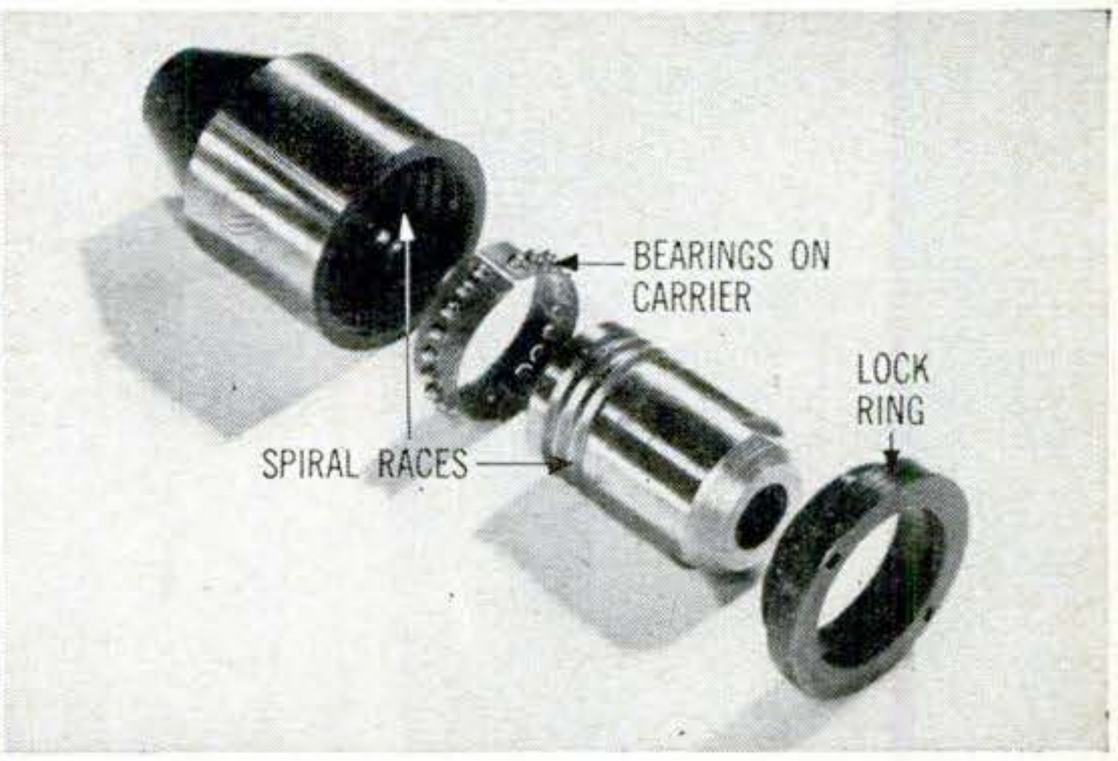
POWER CORD		CHUCK SPEED (r.p.m.)		CURRENT DRAW (amperes)				POWER (watts)		GEARS		BEARINGS			TYPE OF U. L. LISTING
													Type		
Length (ft.)	Grounded Plug	Rated	At Max. Power	Rated	At No Load	At Max. Power	Locked Armature (stall)	Mechanical Output at Max. Power	Electrical Input at Max. Power	No. of Stages	Overall Reduction	Number	Thrust	Other	
10	yes	925	375	5.0	2.1	9.8	23.2	447	992	3	17.5	8	ball	2 ball 5 needle	industrial
6	no	1,000	500	2.5	1.1	3.5	9.0	135	375	2	22.7	7	ball	sleeve	domestic
8	yes	1,000	468	2.2	1.1	2.9	5.8	111	305	2	16.5	6	ball	1 ball 4 sleeve	domestic
6	no	1,000	350	2.6	1.3	5.3	11.0	270	600	2	21.4	5	ball	sleeve	domestic
7	yes	1,000	475	2.5	1.4	4.0	7.5	130	440	2	26.2	6	ball	sleeve	industrial
7	yes	3,200	2,150	4.0	1.8	6.2	14.0	253	640	1	6	4	ball	sleeve	industrial
10	yes	1,000	700	2.4	1.1	3.5	9.5	175	390	2	20.28	6	ball	1 needle 4 sleeve	industrial
10	yes	1,000 2,000	630 1,320	2.4	1.3	4.3	9.0	109	385	n.a.	n.a.	4	ball	sleeve	industrial
10	yes	1,000	700	2.4	1.1	3.5	9.5	175	390	2	20.28	6	ball	1 needle 4 sleeve	industrial
7	yes	1,000	510	2.6	1.3	4.6	10.3	169	492	2	20	6	ball	ball	industrial
8	yes	650	350	3.0	1.3	4.0	10.0	130	400	2	26.25	6	sleeve	1 ball 4 sleeve	domestic
10¼	yes	1,170	670	2.0	1.6	4.0	7.0	165	452	2	19.1	4	ball	1 ball 1 needle 1 sleeve	industrial
6	no	750 2,400	620 2,000	2.0	1.3	3.1	5.5	100	340	2	24.7	5	nylon	sleeve	domestic
6	no	1,000	n.a.	2.5	n.a.	n.a.	n.a.	n.a.	n.a.	2	n.a.	4	sleeve	sleeve	domestic
10	n.a.	1,000 2,000	630 1,220	2.8	1.3	4.3	n.a.	109	385	2	n.a.	4	ball	sleeve	domestic
7	yes	1,000	455	2.5	1.2	4.3	10.0	163	475	2	22.5	6	ball	sleeve	industrial
6	no	925	380	3.1	1.5	5.9	10.0	170	530	2	23	6	ball	sleeve	domestic
6	yes	800	350	2.5	1.0	4.0	8.2	180	450	2	26.45	6	needle	3 sleeve 2 ball	industrial
8	yes	800	350	2.5	1.0	4.0	8.2	180	450	2	26.45	6	ball	2 ball 3 needle	industrial
6	no	1,000 3,000	600 1,800	2.0	.7	2.7	6.0	168	240	2	25	10	ball	sleeve	domestic
6	no	1,000	550	2.6	1.0	2.6	7.5	n.a.	n.a.	2	24.1	4	sleeve	sleeve	domestic





NEW KEYLESS CHUCK requires only a light twist of the fingers to lock in a drill bit or loosen it. An entirely different design from older keyless chucks, it has a ball-bearing carrier that rides in spiral races between the inner and outer barrels of the chuck, as shown above, at right. The result, claims its maker, Supreme Products, 2222 So. Calumet Ave., Chicago 16, Ill., is an almost friction-free action that grips the bit tightly but lets you open and close the chuck easily without a key. The new chuck, currently made in one model to fit ¼" drills, costs $8.50.

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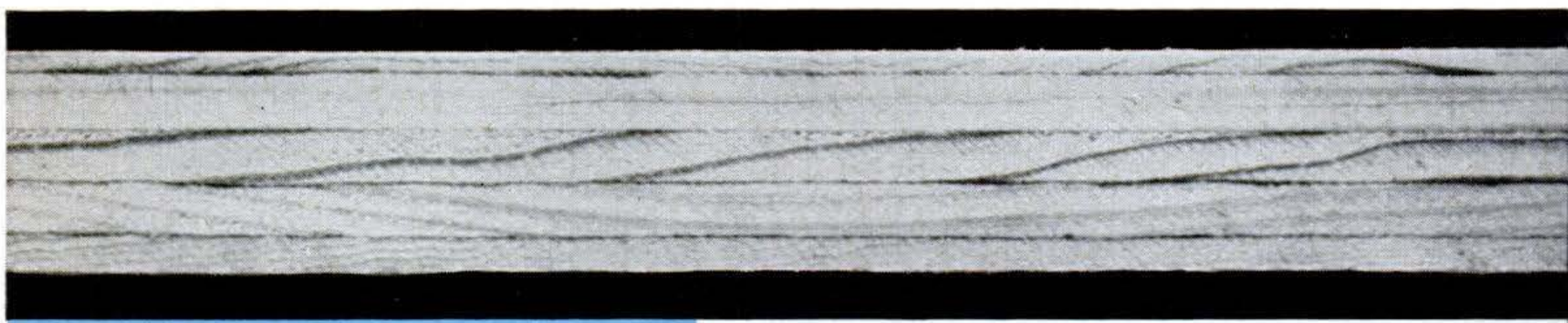
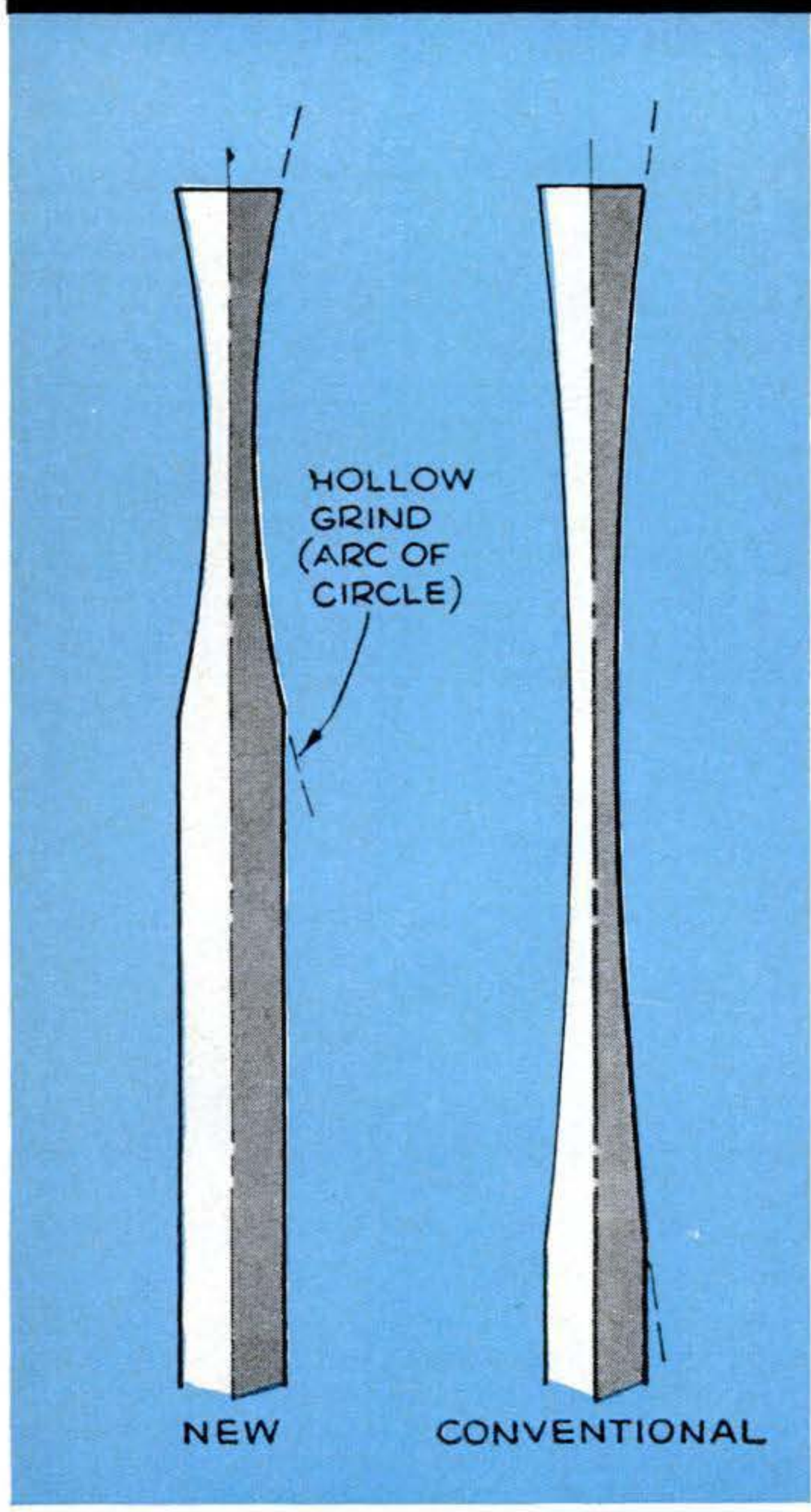
How I Shop-Tested
A Saw Blade That Cuts Plywood Smoothly





PLYWOOD EDGES LOOK BURNISHED (above) after cutting by new blade. Small hollow-ground saw section (see profile at left) leaves a large full-thickness collar for maximum rigidity.

By R. J. De Cristoforo

EVER spend hours filling the roughed-up edges of plywood with wood putty, and then sanding the patches smooth? It's the price you usually pay for cutting plywood with a circular saw.

Now you won't have to. A new kind of blade just put on the market is designed for only one purpose—to breeze through plywood without tearing the grain. Its close-spaced teeth whir through the tough glue lines without chatter or ear-splitting howl. They're tempered to take the abrasive wear, and the kerfs they make look sanded smooth.

The new blade is made in only one diameter—8″. This makes sense. Keeping the diameter down gives it the high torque needed to cut tough plywood easily. Too, you don't need a larger saw to handle this relatively thin material, so why pay for one? Its $8.95 price is in line with that of any other high-quality, hollow-ground blade. The hole diameter measures 5/8″.

Birth of a saw blade. A product like this can't be developed overnight. More than a year ago the manufacturers of the

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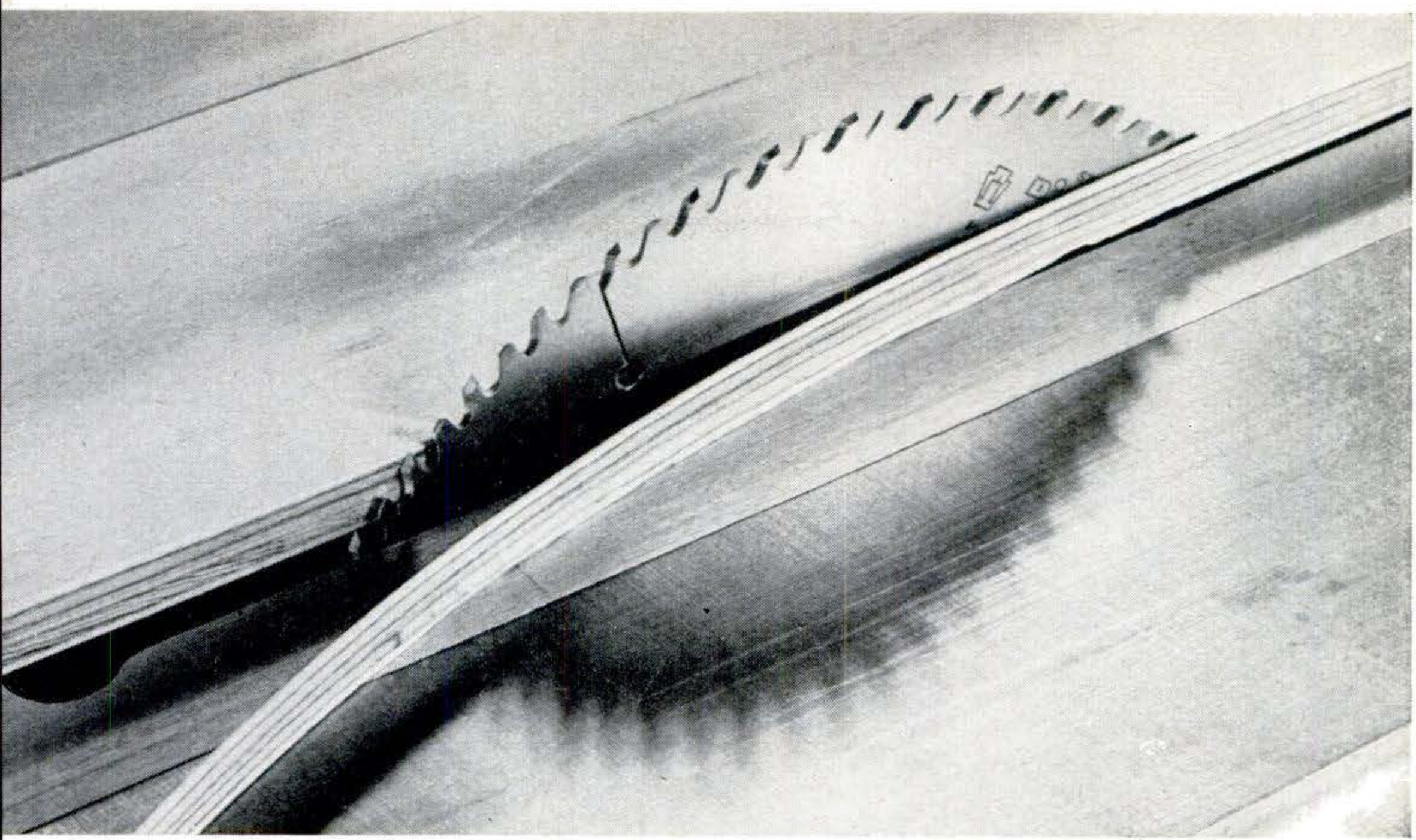

STRIPS AS THIN AS 1/64" can be sliced from plywood easily with new blade. Note complete lack of splintering on top and bottom of the edge. Blade's 8" diameter gives it high torque.

Magna line of shop tools (now Yuba Power Products, Inc.) took the problem of designing the ideal plywood-cutting blade to the Henry Disston division of the H. K. Porter Co.

Engineers of this well-known saw-making outfit knew that such a blade must have certain basic features. First, there could be no saw set. Even the slightest amount would prevent the smooth cut wanted. Instead, clearance would have to be provided by hollow-grinding (reducing the thickness of the blade immediately below the teeth). At the same time, the saw would need plenty of "muscle," or stiffness.

Disston's success with a hollow-ground, smooth trimmer, which they had developed for crosscutting two-by-fours and two-by-sixes, led to a retake of this product. Known as the style "P" saw, it had extremely sharp points that practically burnished the end grain.

Trial and error. Unfortunately, tests on plywood showed that this saw's keen points would not hold up when exposed to the damaging action of the glue lines. But experience convinced them that an extra gauge of grinding would reduce the friction considerably, lessening the expansion of the metal that caused binding and burning. They settled for a clearance of four gauges (three is standard for a conventional, hollow-ground blade).

While on the subject of grinding, someone pointed out that since this new saw was being designed to cut through stock no more than ¾" thick, there was no need to run the dished-out areas far back from the base of the teeth. A distance of 1½" would give the necessary depth of cut, plus plenty of clearance. Result: The blade would have a large, stiffening collar section of full gauge.

Teething pains. The saw was beginning to shape up. However, there still remained the problem of putting teeth in it. What kind of teeth, and how many?

The style "P" saw was used again as a starter. An alternate face bevel of 45 degrees gave its teeth much of their super-smooth cutting action. This bevel was retained in plans for the new blade.

But the trimmer's long, sharp points were out. A much higher tooth back was proposed, to put plenty of beef behind the cutting edge.

As to the number of teeth—the more

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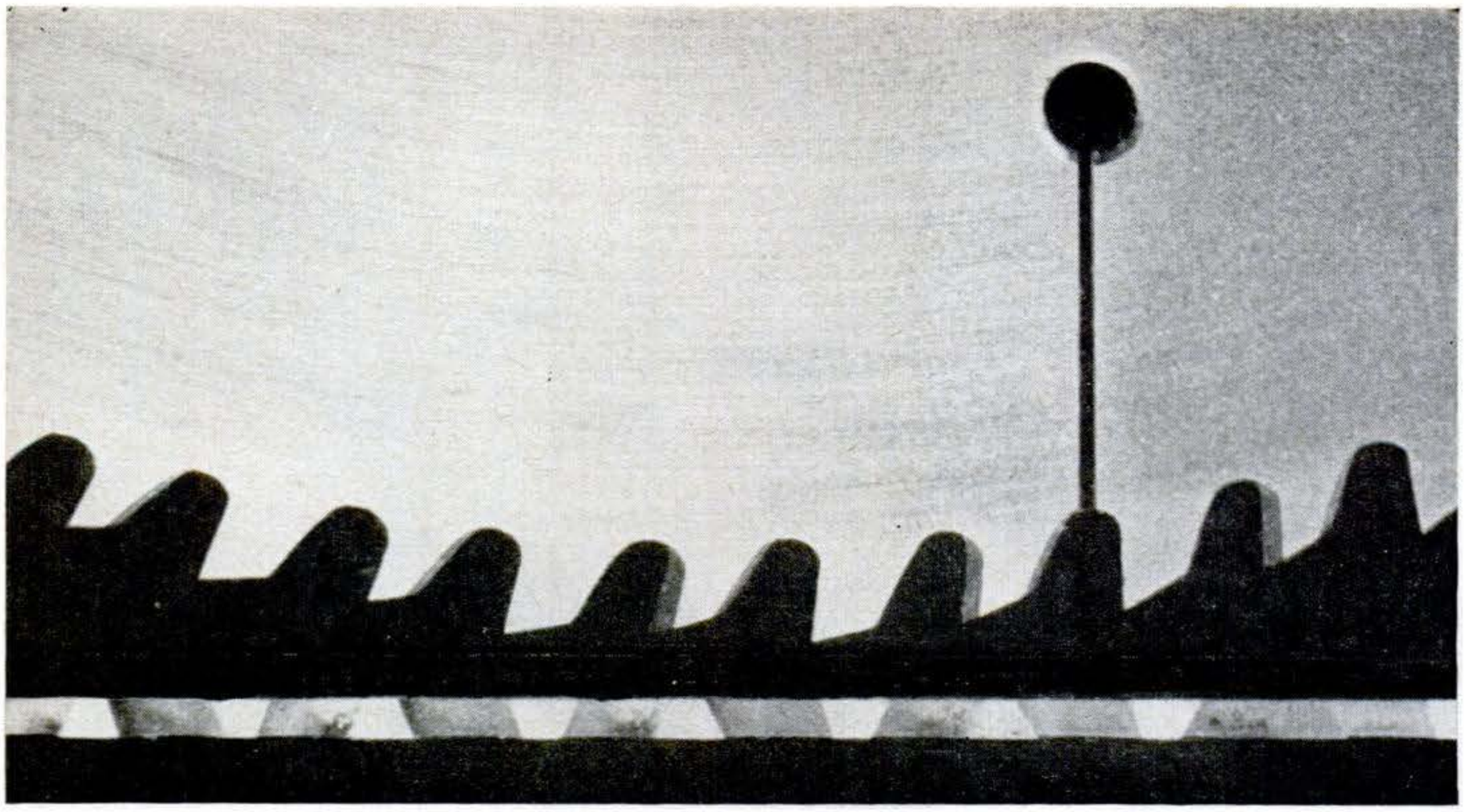

FLUTTER IS MINIMIZED by chunky, high-backed teeth, while alternate 45-degree face bevels produce super-smooth cutting. Note sound-damping slot and hole, one of three around blade.

you could crowd around the blade, the smoother the cut would be. That was in theory. In practice, it doesn't always work that way. There are such variables as the average speed at which the blade will turn, and how fast the stock is fed into it.

Disston put automatic machines to work, shoving the laminated stuff into various saws, while delicate instruments tipped off the engineers. Results were not conclusive. For best performance the blade would need 60 to 80 teeth.

One thing was clear, however. Because this was to be a hollow-ground blade, there was no need to keep the metal soft enough for tooth resetting. After a number of experiments with plates of varying hardness, just the right temper was found. Saw teeth so treated nibbled nonchalantly through the glue lines, without danger of fracture at any reasonable arbor speed.

Now it was time to make a pilot model. Disston didn't settle for one. They turned out more than a dozen, each with a slight variation of design. These blades were sent to Magna.

Proof of the pudding. That was where I came into the picture. I'm a leisure-hour woodworker. Magna knew it and made me the guinea pig for an entirely different run of tests. The engineers and metallurgists had had their day. Now it was my job to put these blades through their paces in a typical home workshop. I was to give them every manner of use—and abuse.

I spent a week at it and there was no doubt in my mind when I finished. An 80-tooth blade was my choice on all scores. It had only one fault; it screamed like a banshee. But so did all the other saws.

The winner. I sent the code number of my favorite back to the factory. I didn't know then, but I soon found out that I had verified the laboratory tests. This was the model that stayed sharp longest, and showed minimum power consumption.

Everybody seemed happy until I pointed out that no home-woodworker's wife—and mine backed me up on this—would tolerate the irritating noise level. At first, technicians suggested that better attention to manufacture would eliminate this defect. But when six production-line models set up the same howl, they had to try another tack.

This time they bored three equidistant holes through the hollow-ground section and ran slots out through the saw edge. This broke up the regular air disturbances created by the teeth, and there was no more scream. But it did more than that. It allowed the blade to expand and contract to an extent impossible otherwise. That's a bonus feature for the guy who abuses a saw to the point where it runs hot. But Yuba hopes nobody will take advantage of it. END

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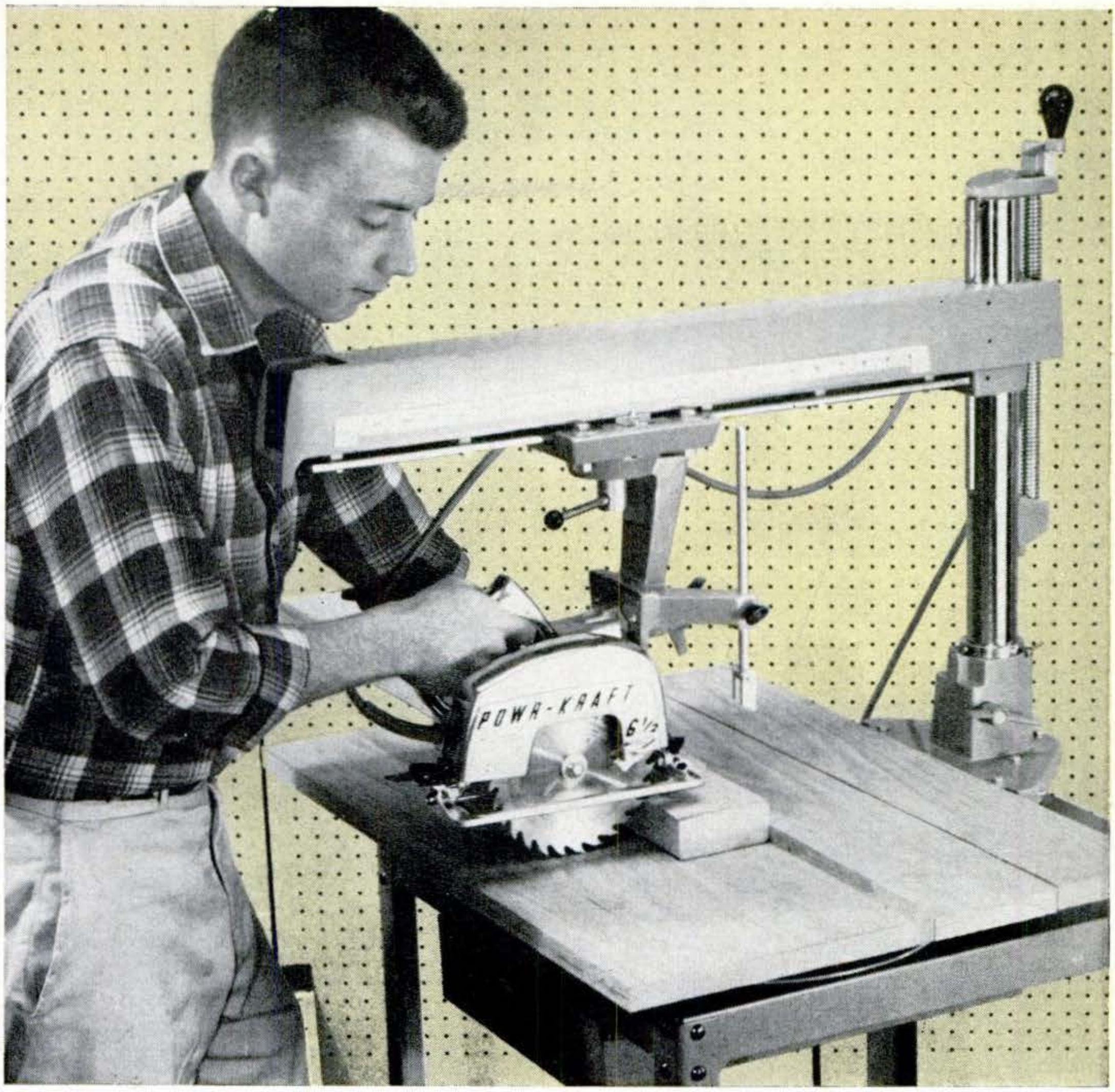

what's new in power tools

Portable saw converts to a radial saw in a quick switch when you attach it to the swinging overarm shown above. Introduced this month, the radial arm is a brand-new idea in power tools that doubles the use of a portable saw.

With a saw clamped to the sliding carriage, the tool performs the functions of a full-fledged radial-arm saw. It swings and tilts for angle cuts, crosscuts boards up to 16″ wide and will rip to the center of a 49″ panel.

Attaching the saw is a simple matter of removing the sole plate and locking the handle to the radial carriage with a single bolt. Sixty ball bearings in the carriage roll easily on the overarm track for smooth operation. The arm comes complete with metal base, sectional wood table and adjustable guide fence. You can set up the tool on a bench or on an accessory metal stand.

The radial-arm tool is sold under the Powr-Kraft label by Montgomery Ward, 618 W. Chicago Ave., Chicago. It's priced at approximately $100.

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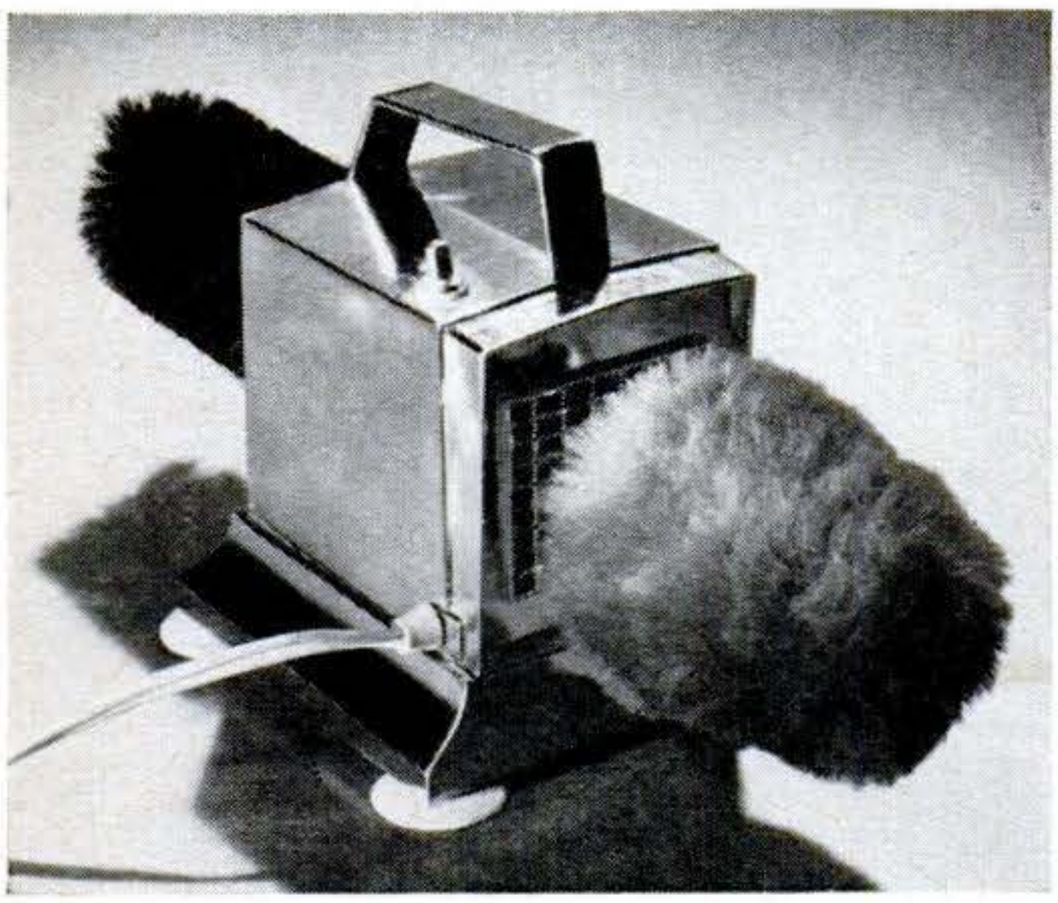


1 High-styled power pack is a brand-new Dremel portable unit that drives grinding, drilling, carving and polishing attachments chucked in a 30″ flexible shaft. Extra attachments convert the unit into a bench grinder or buffer. With an accessory kit, it even becomes a shoe polisher (above). Four suction-cup feet prevent scratches and anchor the tool tightly in place so you can push against it without bolting it down. It weighs less than six pounds and is easily carried by a convenient handle. The 1/15-hp. brushless AC motor turns at 3,450 r.p.m. The Dremel Mfg. Co., Racine, Wis., sells the power pack in two ways: as a power tool with flexible shaft at $32.50, or as a shoe polisher with bristle brush and polishing bonnet at $24.95.

2 New low prices on two popular power tools made by the Porter-Cable Machine Co., Syracuse, N. Y., may indicate a trend toward budget tools to stimulate buying in the do-it-yourself market.

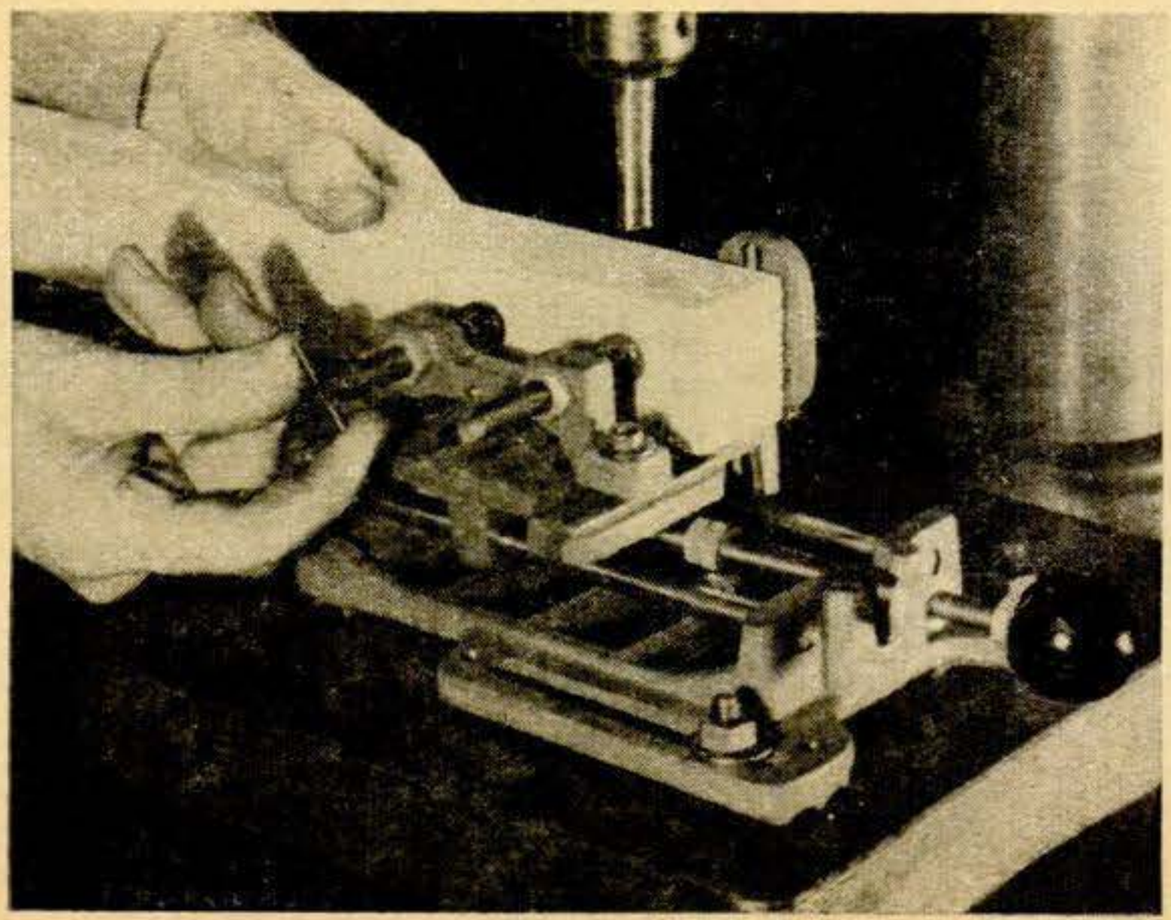
Wearing a price tag of $39.95, Porter Cable's new 6½″ portable saw, Model 66, (2A, at right) provides features of higher-priced models—tilt, depth adjustment, and a husky eight-amp motor.

Also hitting a new low in price tags is a 2½″ belt sander, Model 165, (2B) selling for $49.95. It handles any surfacing job from rough sanding to fine finishing.

3 Two direct-drive chain saws have been added to the Titan line, made by Propulsion Engine Corp., South Milwaukee, Wis. The 21-pound saws are powered by a 4.7-cu.-in. engine, and can be had with 14″, 20″ or 24″ chain bar. Model 4800 (at right) is priced at $160, $170 and $178 depending on bar length. Model 4900 at $187, $192 and $200 features a right-hand starter.

4 New to the Disston line this year is a husky 10-amp portable saw—their first (4A, at right). Priced at $54.50, it's equipped with a chrome blade, said to reduce friction and deter wood-gum accumulations. It cuts to 2⅛″ depth at 90 degrees, 1⅞″ at 45 degrees.

A new electric handsaw priced at $54.50 (4B) now follows a $98.50 model introduced last year by Disston. The



Mortise cuts come easy with this new vise—almost like drilling a hole. Patterned after much higher priced milling vises, the new attachment, at left, bolts to a drill-press table and has a sliding carriage. Work clamped in the vise is slid back and forth under the router bit, which automatically mortises until the desired depth is reached. Akron Precision Equipment Co., P.O. Box 5256, Akron, Ohio, sells the vise—called Mortise-Master—for $14.95.

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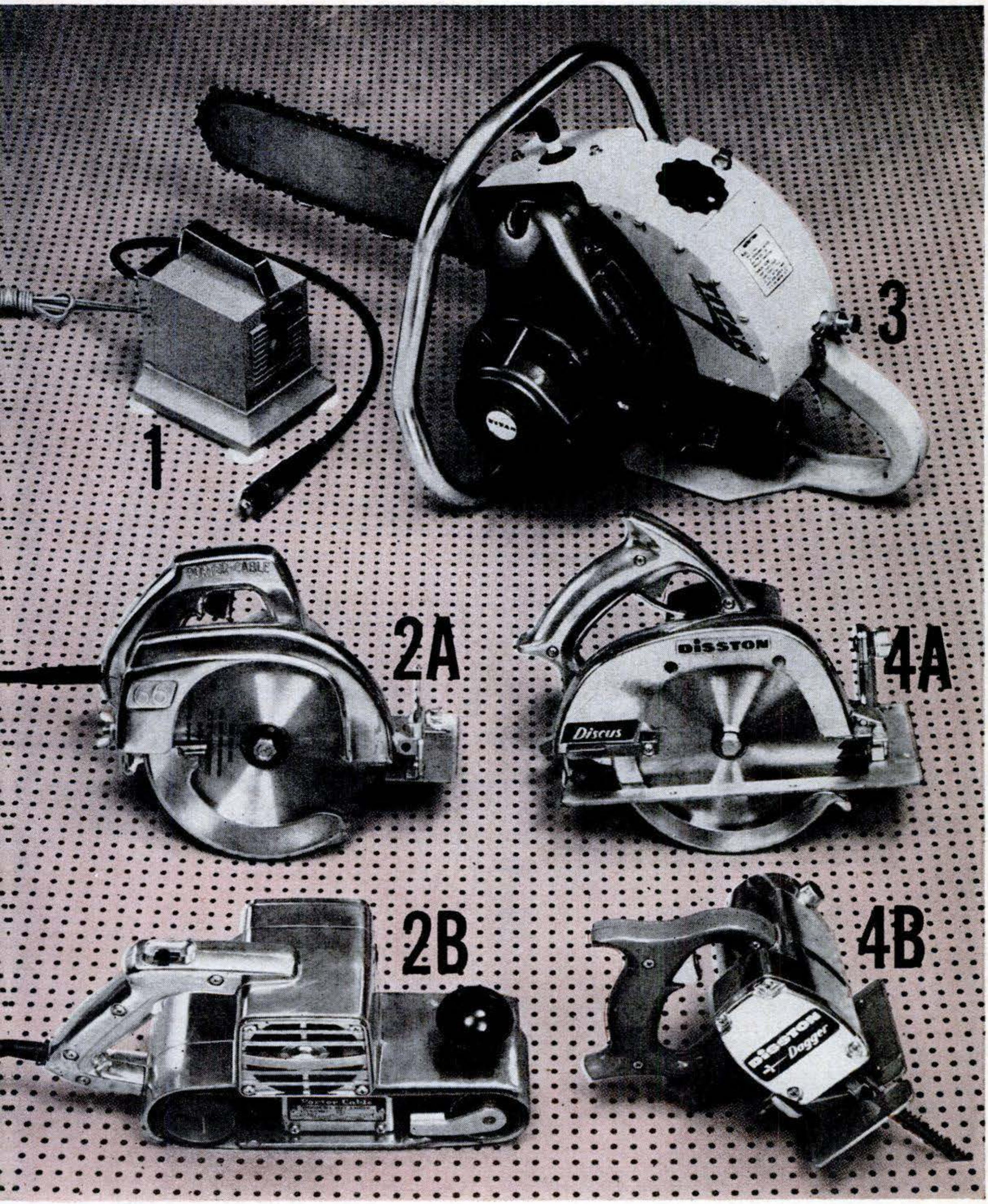

higher-priced professional model is still available, but the use of a different motor, oilite instead of ball-and-needle bearings, plus other production refinements have resulted in lower manufacturing costs and a new tool designed and priced for the home shop. The saws, made by the Disston Division of H. K. Porter Co., Inc., Philadelphia, are all fitted with a comfortable handsaw-type handle and a 10′ detachable cord, with 25′ and 50′ cords available at extra cost.

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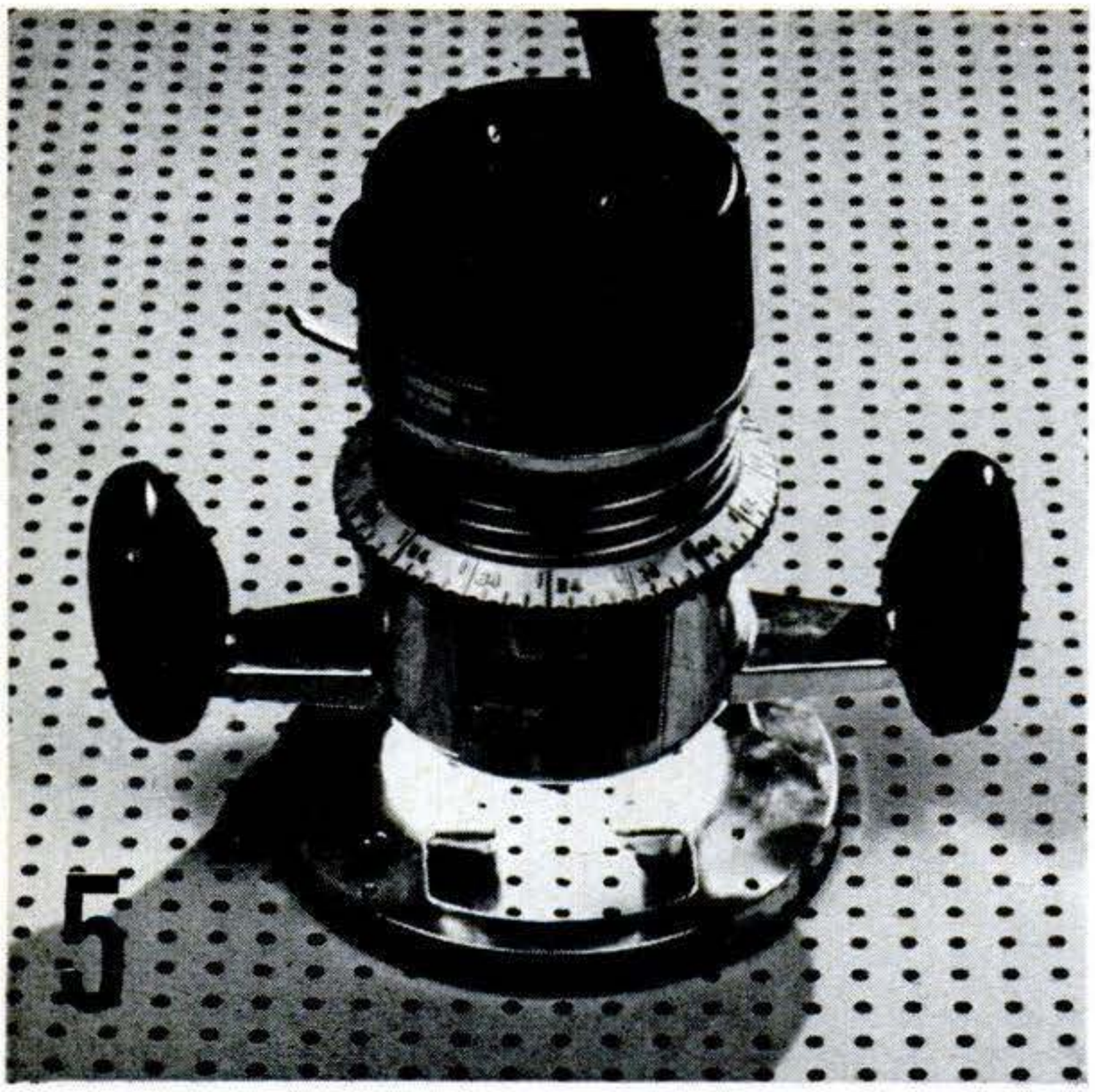

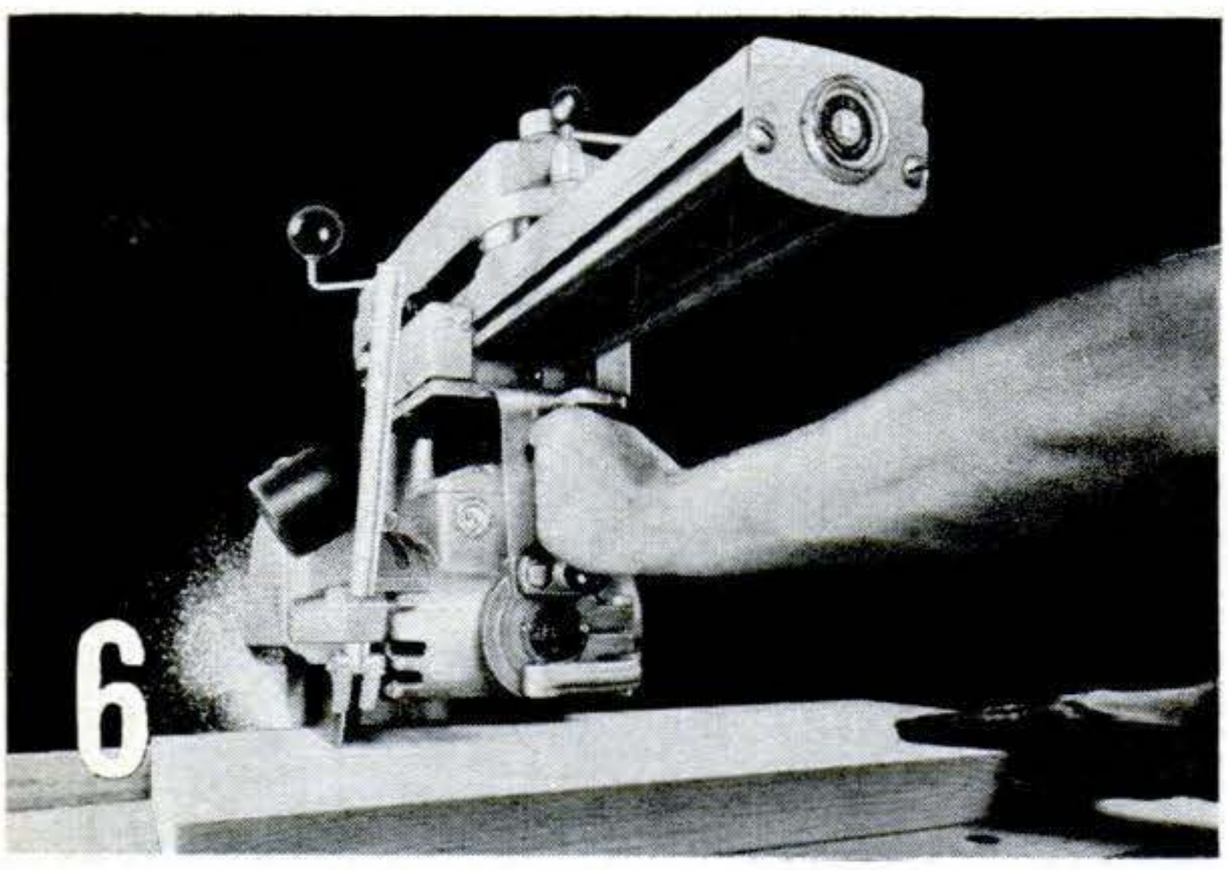

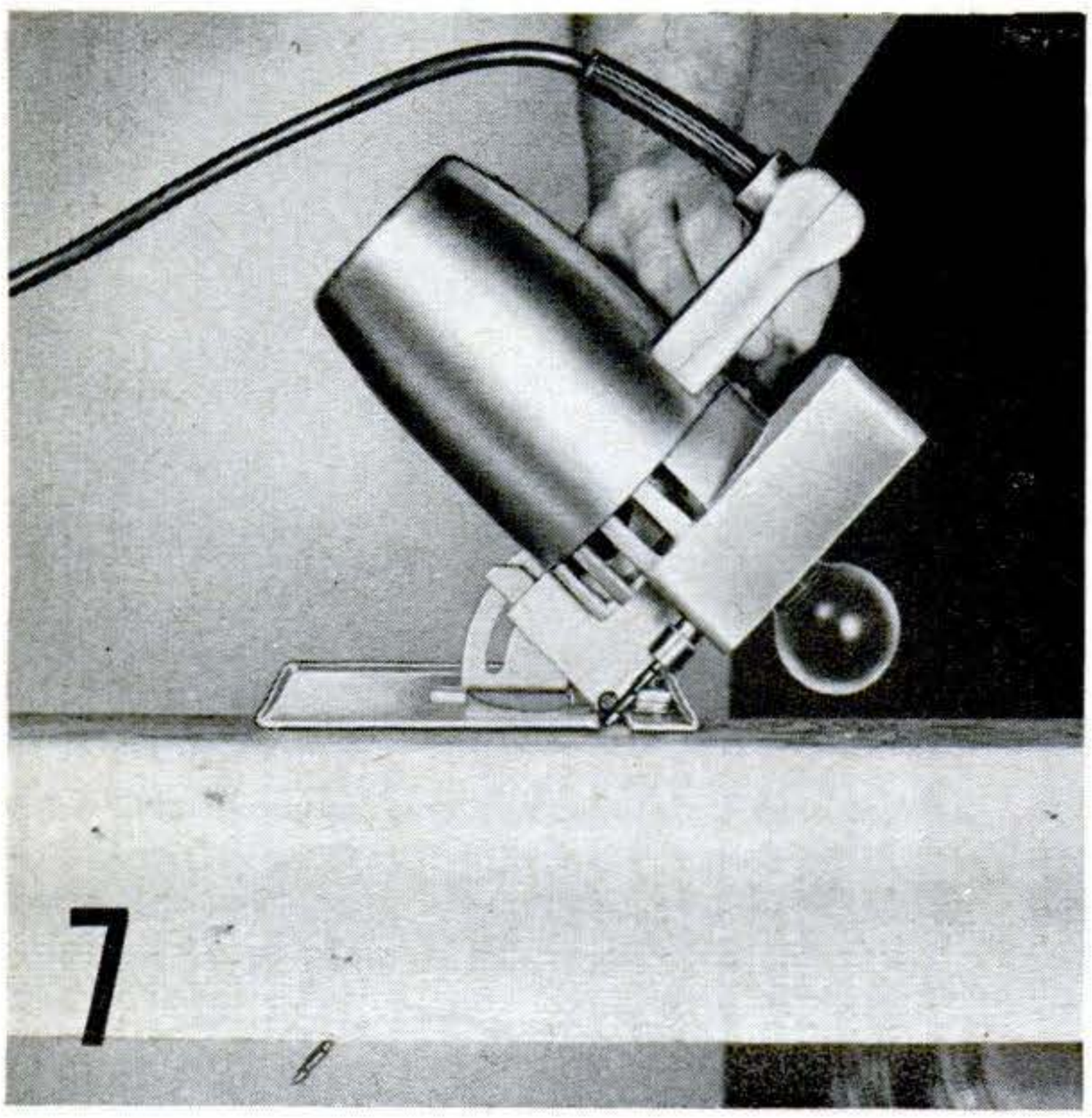

what's new in power tools

5 A headlight on this router helps you see exactly where you're cutting—even in the dark. Thought up by Stanley, the first-of-its-kind guide light gets brighter as the going gets tougher, providing more light as well as a warning signal against overload.

Depth adjustment is made easily by sliding the motor housing straight up and down in the base, instead of rotating it, so that the switch is always in the same place for instant triggering on or off. A rotating ring lets you "fine-tune" the cutter depth to within a whisker's .004".

Even the handles—half squarish, half roundish—have been redesigned for easy gripping from any position. The ⅞-hp., 23,000-r.p.m. router will sell for $62.50 from Stanley Electric Tools, 111 Elm St., New Britain, Conn.

6 Slicked-up radial saw has been redesigned by Delta for a full one-hp. rating and is said to develop up to two hp. under load. New front controls on the 9" saw permit fast, safe positioning of the guide fence. The newly named Super 900, priced at $239, is made by the Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh.

7 Souped-up saber saw, said to have the largest cutting capacity of any model on the market, may indicate a trend toward bigger, more versatile electric handsaws. Powered by a full ½-hp. motor, the Wen's remarkable super-long blade slices through four-by-four timbers on a 45-degree slant (at left) and will even cut 6"-diameter cordwood for your fireplace. Other chores it enjoys: munching through steel and other metals up to ½" thick, iron pipe up to 2" in diameter, and plastics, plywood and hardboard. Introduced this month, the 909 saw is priced at $44.95 by Wen Products, 5810 Northwest H'way, Chicago.

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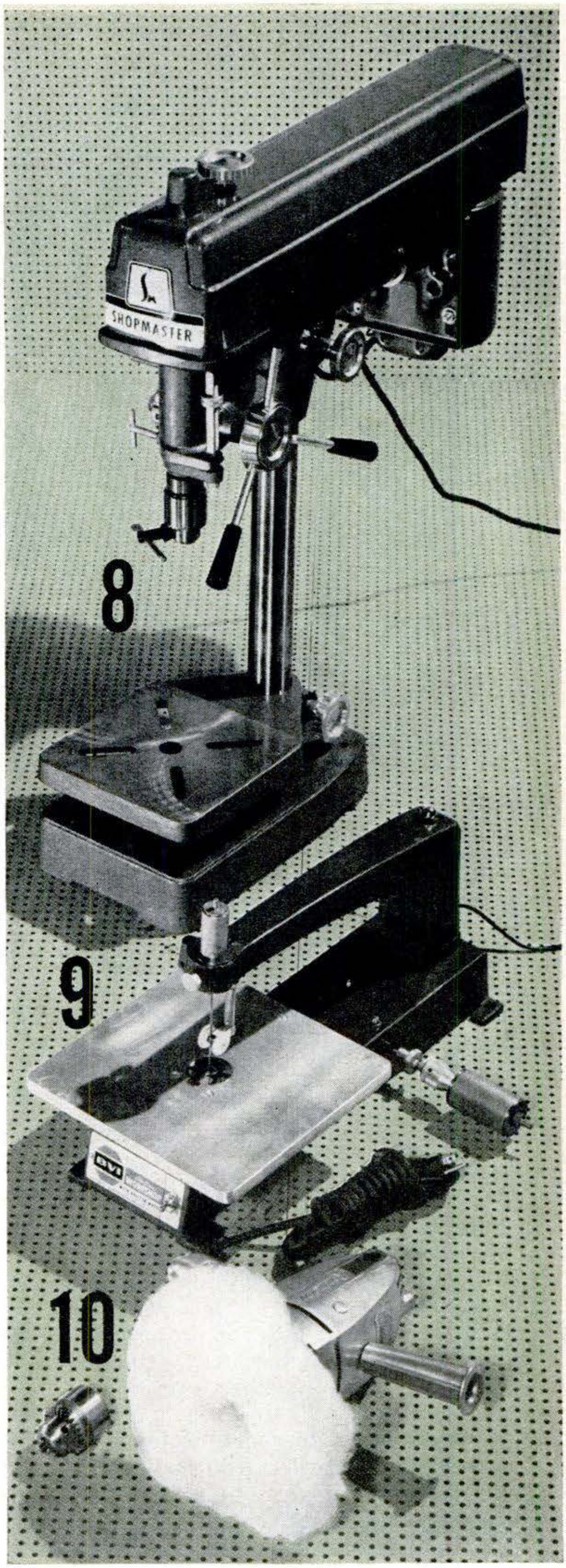
8 Radial-arm drill press adds the versatility of a swinging overarm to the ruggedness of a standard drill press. The new Shopmaster design—actually a home-shop version of much bigger, costlier industrial models—makes it possible to drill in any position and at any angle without moving the work. The spindle-and-motor carriage swings from side to side, tilts in either direction and slides forward and back, enabling you to drill up to 24" from the edge of wide stock.

The radial-arm drill press is one of the first in a new line of power tools being announced this year by Shopmaster, Monticello, Iowa. It will sell for $109.95. Other new power tools will include bench saws, bandsaws, jigsaws, jointer-planers and drills.

9 Quick-change jigsaw turns into three different power tools. Its pivoted overarm works as a conventional jigsaw with a 24″ throat, or the arm can be removed for making unlimited cuts with a heavy-duty saber blade. A power-take-off chuck at the side also drives standard ¼″-drill accessories at 3,000 r.p.m. for drilling, sanding, grinding, buffing, wire-brushing and other jobs. A small piston mounted on top of the overarm pumps air to clear chips away when the tool is used as a jigsaw. Burgess Vibrocrafters, Grayslake, Ill., sells the multipurpose saw for $29.95.

10 A heavy-duty polisher-sander made by Remington operates at 1,200 r.p.m. to handle tough surface-finishing jobs on wood or metal. Priced at $64.50, the powerful eight-amp tool comes with a 7″ rubber backing pad, sanding disks and a wool polisher. A ½″ chuck at $7.60 is available to convert the sander into a husky ½″ drill. A full-grip metal handle can be screwed into any of three locations to provide the most comfortable position for sanding, polishing or drilling. The triple-duty tool is one of the first in a new line of power tools made by Remington Arms Co., Bridgeport, Conn.



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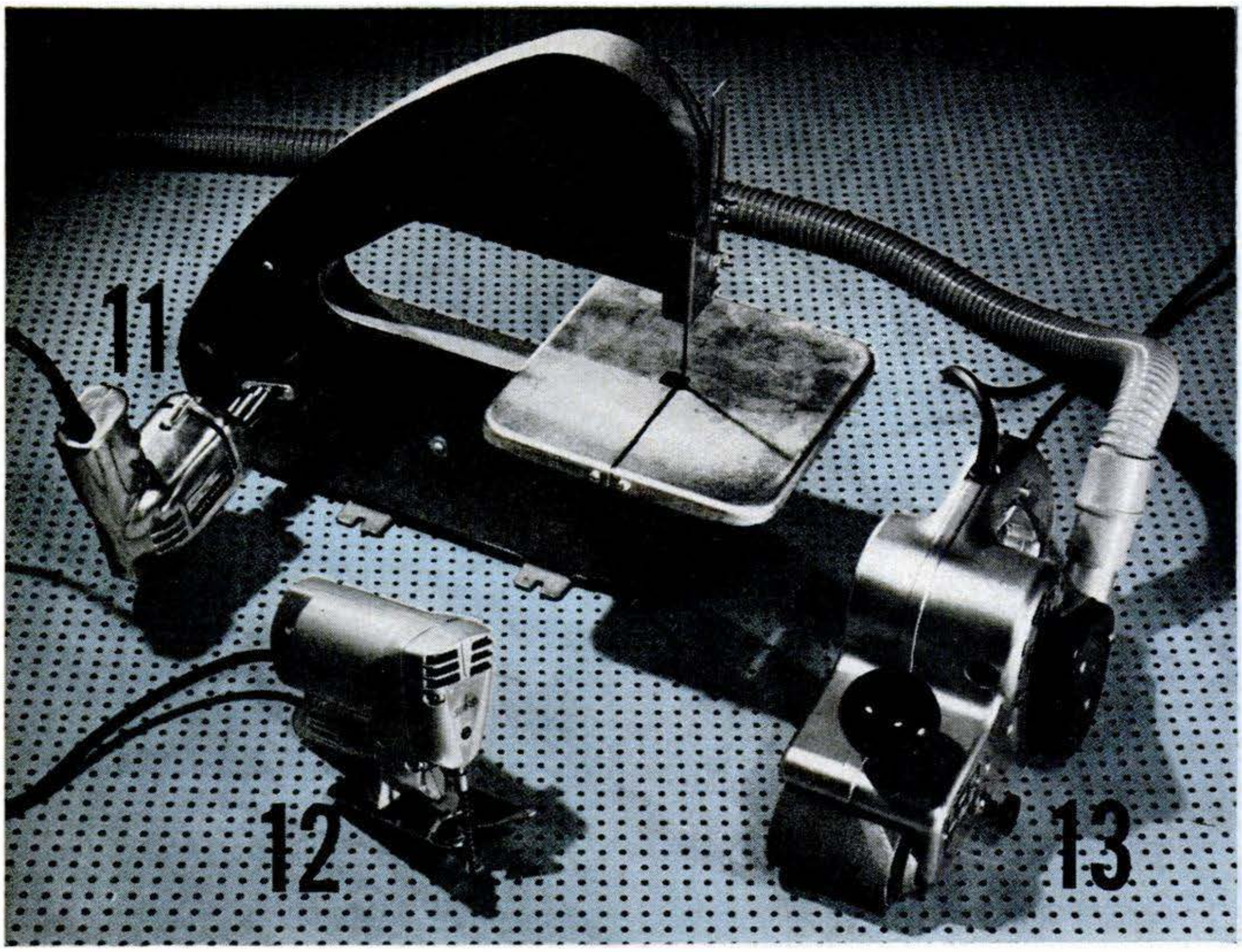


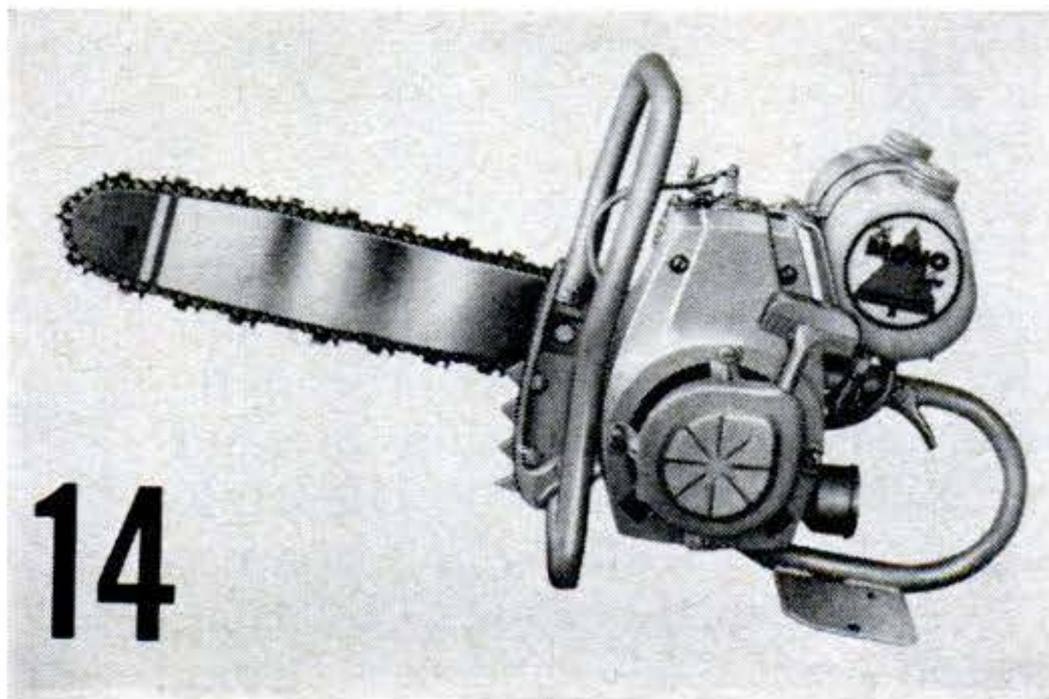
what's new in power tools

11 Bandsaw powered by electric drill. Any electric drill having a bolt-down stand (the type used to hold a drill for grinding and polishing operations) can be used to drive this $17.95 bandsaw. Made by Pincor Products Corp., 5941 West Dickens Ave., Chicago 39, the tool will cut plywood or lumber up to 2⅜″ thick. A 10″ throat permits cutting to the center of a 20″ board. The table tilts to 45 degrees for angle cuts.

12 New saber saw fresh off the drawing boards of the McGraw-Edison Co., Booneville, Mo., incorporates several new ideas. A blast of air behind the blade keeps the cutting line free of dust. Extra blades can be stored in a clear handle which is also the tilt lock. A switch beside the operator's index finger helps quick shut-off. Price: $34.95.

13 Sander hitches to vacuum cleaner. A 5′ flexible hose lets you hook this 3″ belt sander to a vacuum cleaner to carry away sawdust. Although designed as a professional-duty tool, it will work with industrial or household-type cleaners. The $98 sander with hose will be introduced this month by Black & Decker Co., Towson, Md.

14 Low-cost chain saw designed for the occasional user who wants good performance at a rock-bottom price is shown below. It is the Mono Model 1-16, a well-made but plainly finished tool weighing 23 pounds. Priced at $99.50, it has a 16″ bar and chain, and a diaphragm carburetor. Mono Mfg. Co., 540 East Commercial, Springfield, Mo., makes the saw.



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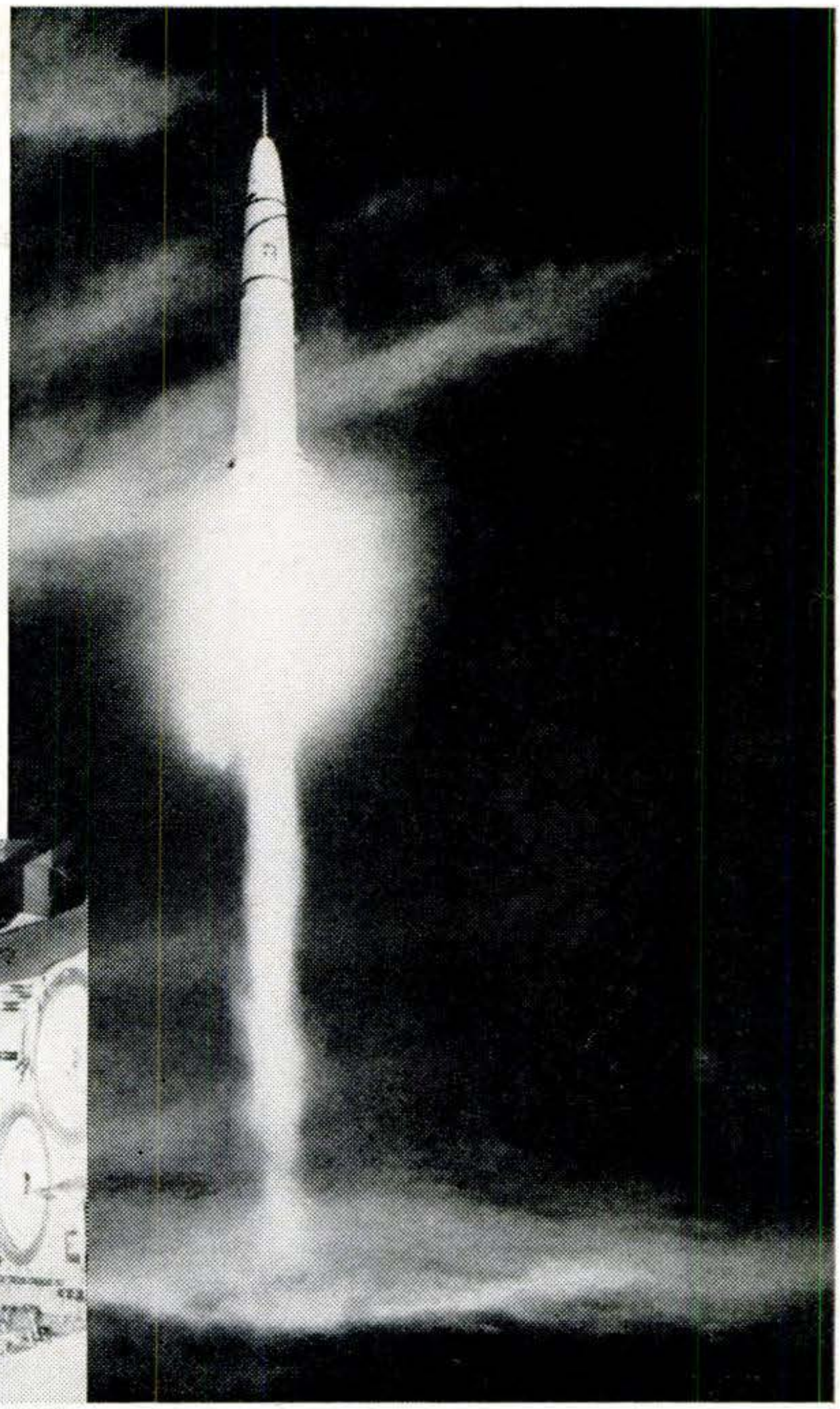

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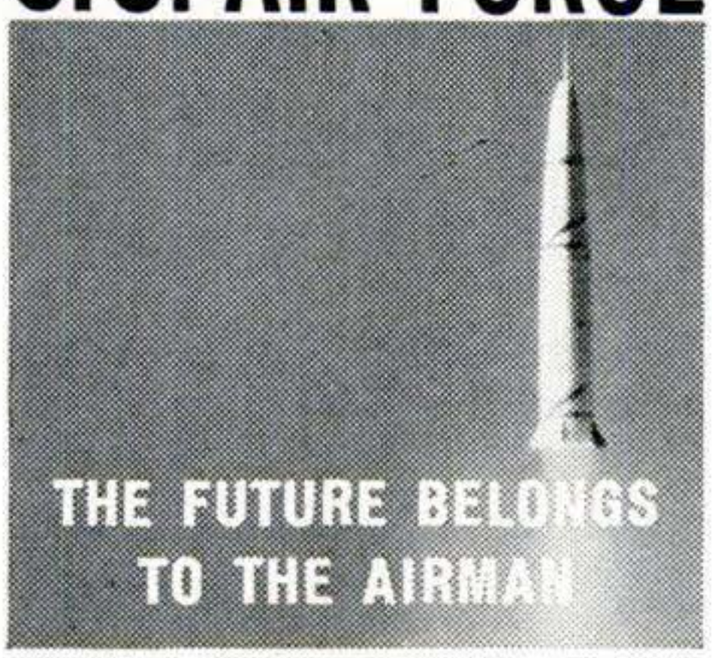

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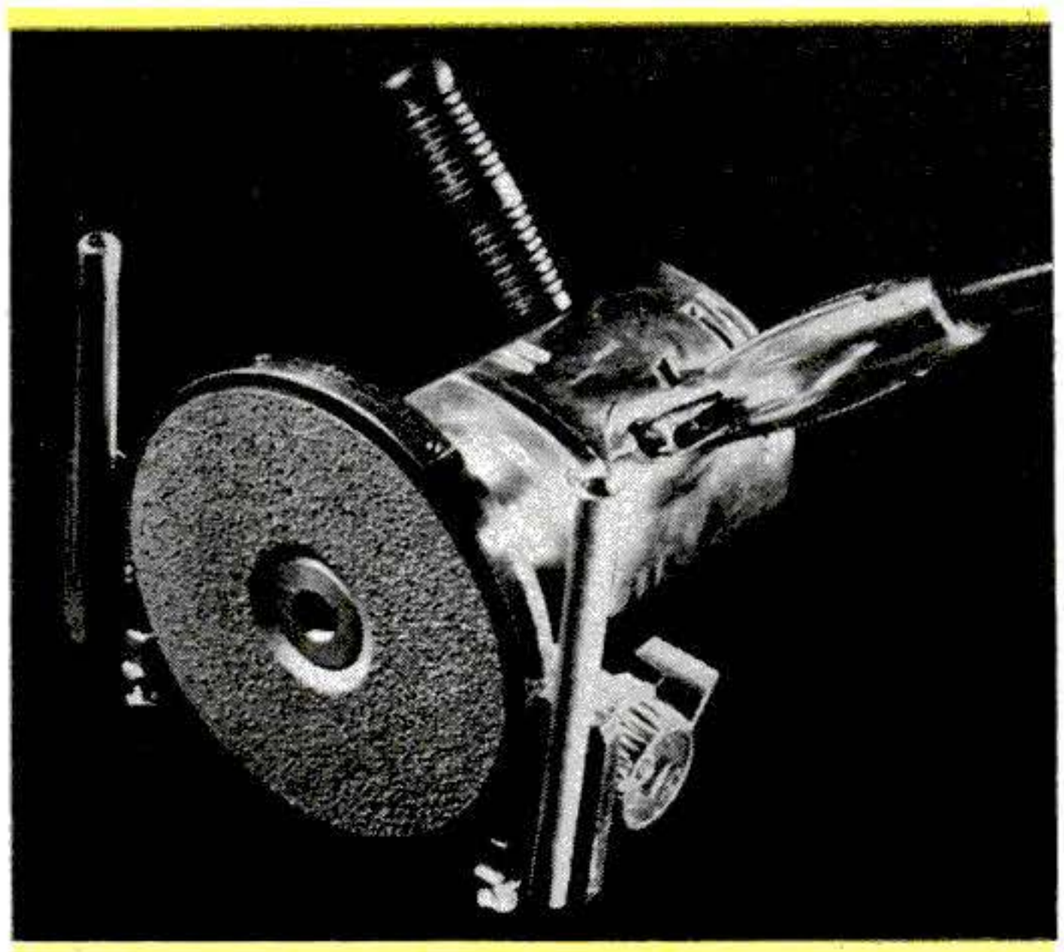
what's new in tungsten carbide abrasives

TUNGSTEN carbide grits brazed on steel are in the news again. First made available to the handyman by the Skil Corp. last year, this practically indestructible abrasive is now offered by a number of manufacturers in a variety of surfacing attachments and tools.

Tungsten carbide abrasives are expensive. But in terms of the work they do, they're cheaper than sandpaper, which they outlast as much as 100 times to one. In addition, they cut twice as fast, and are practically clogfree.

Shown on the opposite page are seven new tungsten carbide products. They are:



Controlled-depth sander. Designed especially to make the most of tungsten carbide disks, the new power tool shown above takes the guesswork and gouges out of flat sanding and paint removal. It looks and works much like a router. To use it, you preset the disk for the depth of cut you want—like a router bit. The circular housing then forces the disk to sand to this level and no farther. Adjustable rails let you guide the tool accurately along any edge.

Offered by the Porter Cable Machine Co., 124 Exchange St., Syracuse 4, N.Y., under the trade name "Paint Remover," the controlled-depth sander sells at $69.95 including the disk head, assorted tungsten carbide disks, sponge rubber backup pads and auxiliary handle.

1 **Disks** that can be cemented on face sanders. Diameters are 8", 9",10" and 12", priced from $5.60 to $11.95. They're made by Skil Corp., 5033 Elston Ave., Chicago 30. Skil uses the trade name "Perma-Grit" for all of its tungsten carbide line.

2 **A sander kit** consisting of sanding block and sander plane. The plane's blade has coarse grit on one side, fine on the other. Varying abrasive surfaces are offered for the block. Kit price: $4.95. Skil Corp.

3 **A contour file** with a convex abrasive face. Price: $1.95. Skil Corp.

4 **Two cutting wheels** for portable electric saws. One has abrasive on its edge and on ½" of each side for cutting splintery materials like thin plywood. The other is fully coated on both sides for cutting and sanding when a portable saw is used in a stationary table. Prices: from $5.10 to $9.50. Skil Corp.

5 **Fine and medium sanding blocks** with the abrasive permanently attached, on the theory that they last so long you can afford to throw them away when the grit wears out. Price: 99 cents each. Made by Millers Falls, Greenfield, Mass. Also, an abrasive blade for the Plane-R-File this company introduced last year. Price: 89 cents.

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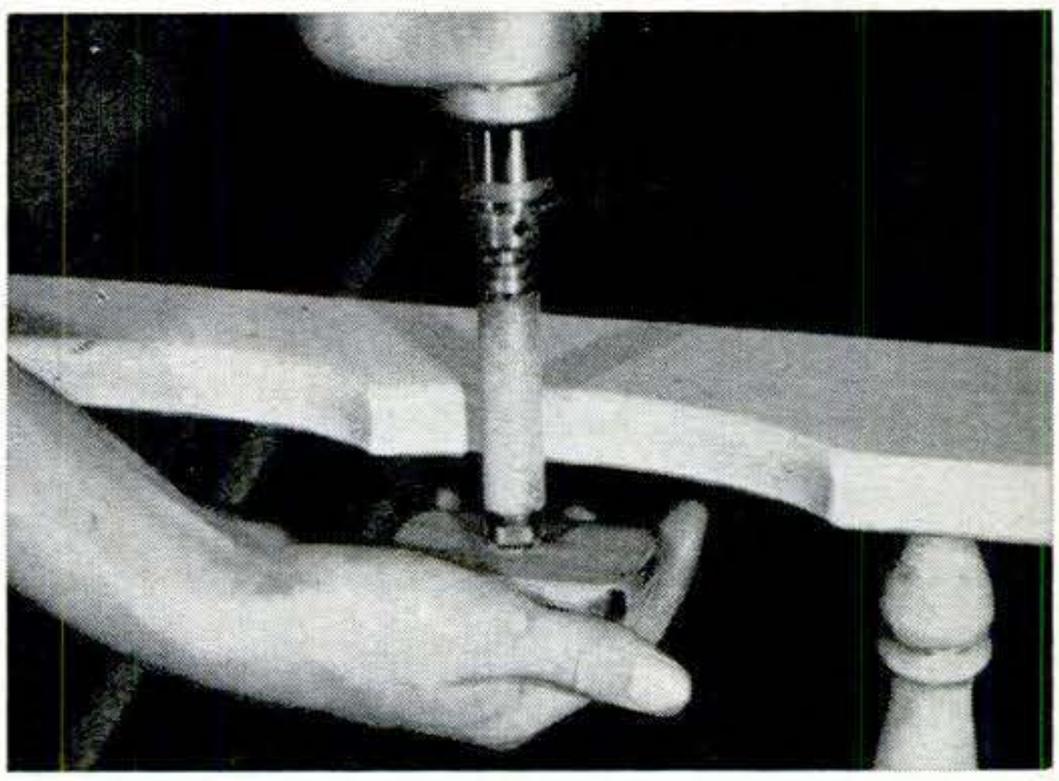
6 Tungsten carbide sanding drums in a number of diameters. Chucked in a drill press or electric drill, they make short work of smoothing inside curves. Prices: from $5 to $11.75, with arbor. Manufactured under the trade name "Roto-Files," by R. A. Ness & Co., 5083 Elston Ave., Chicago 30.

7 Disks with recessed center holes for use with rubber sanding disks attached to electric drill. Offered in 5″, 6″, 7″ and 8″ diameters at from $1 to $1.75. PAR Enterprises, Box 23, Northbrook, Ill.



ROTO-FILE END IS STEADIED with a hardwood bearing block when used in an electric drill.

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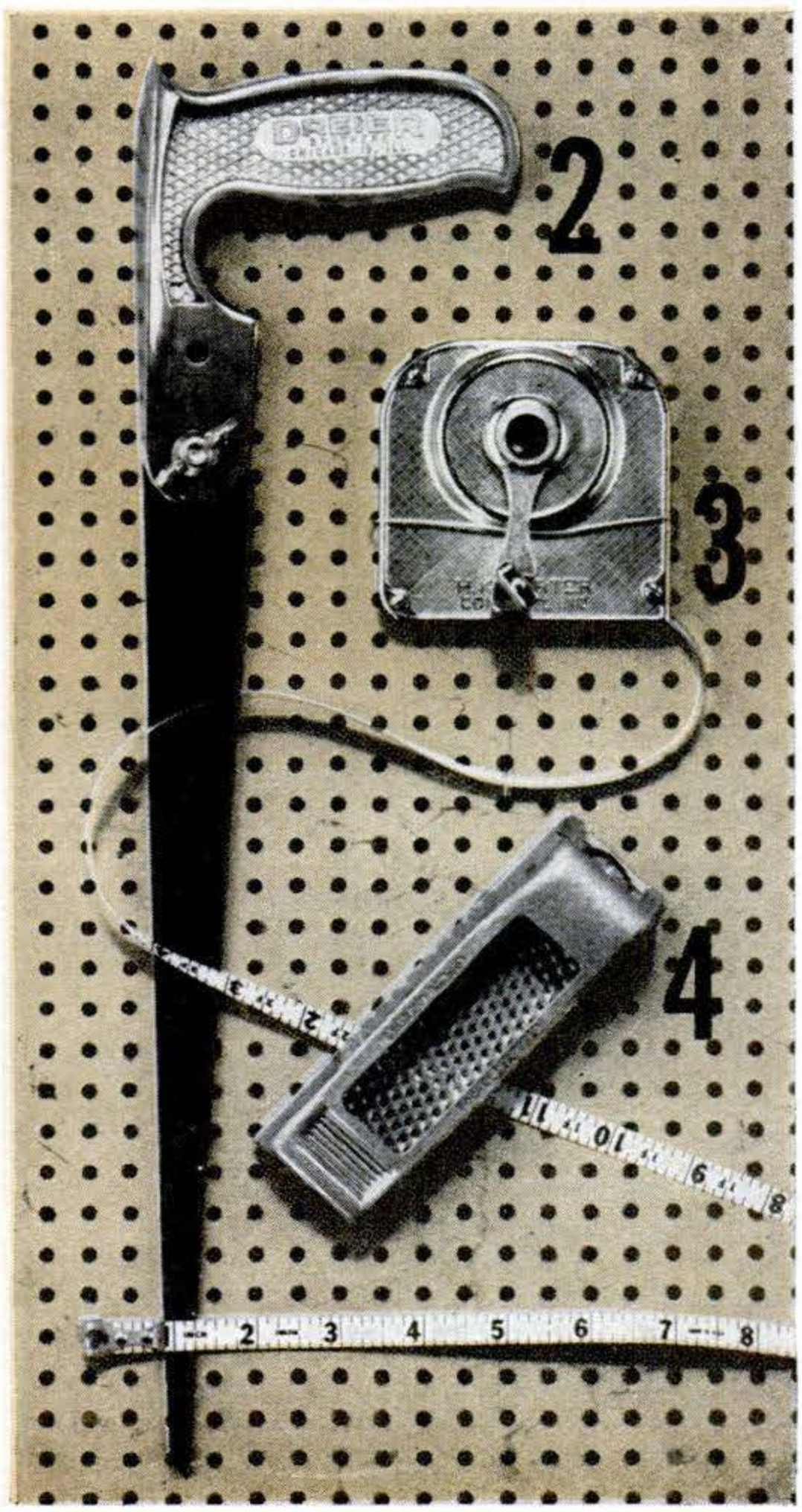
what's new in hand tools



1 One-hand wrench. A rack and pinion automatically adjusts the jaws of this wrench as you pull the handle to one side or the other. With it, you can efficiently tighten or loosen nuts with only one hand. The Custanite Corp., 1228 Utica Ave., Brooklyn, N.Y., offers you a choice of three sizes for $2.95, $4.25 and $5.95.

2 Compass saw with a handle that takes reversible plaster-, wood- and metal-cutting blades uses a convenient quick-action lock to hold them in place. Blades cost $1.50 apiece; a black handle, $1.75; a polished one $2.20. Magic-Slot compass saw is made by Dreier Bros., 7301 S. Woodlawn Ave., Chicago 19.

3 New geared tape winds in long rules three times faster because of a unique 3:1 speed step-up built into the crank. The rules come in 50′ and 100′ lengths from Disston Division, H. K. Porter Co., 39 Tacony, Philadelphia.

4 Small forming tool for one-hand operation has been added to the two large Surforms introduced by Stanley several years ago. Only pocket-size, the new tool shapes and trims wood, plastics and soft metals. Price is $1.49, with replacement blades available for 75 cents each. Stanley Tools, New Britain, Conn.

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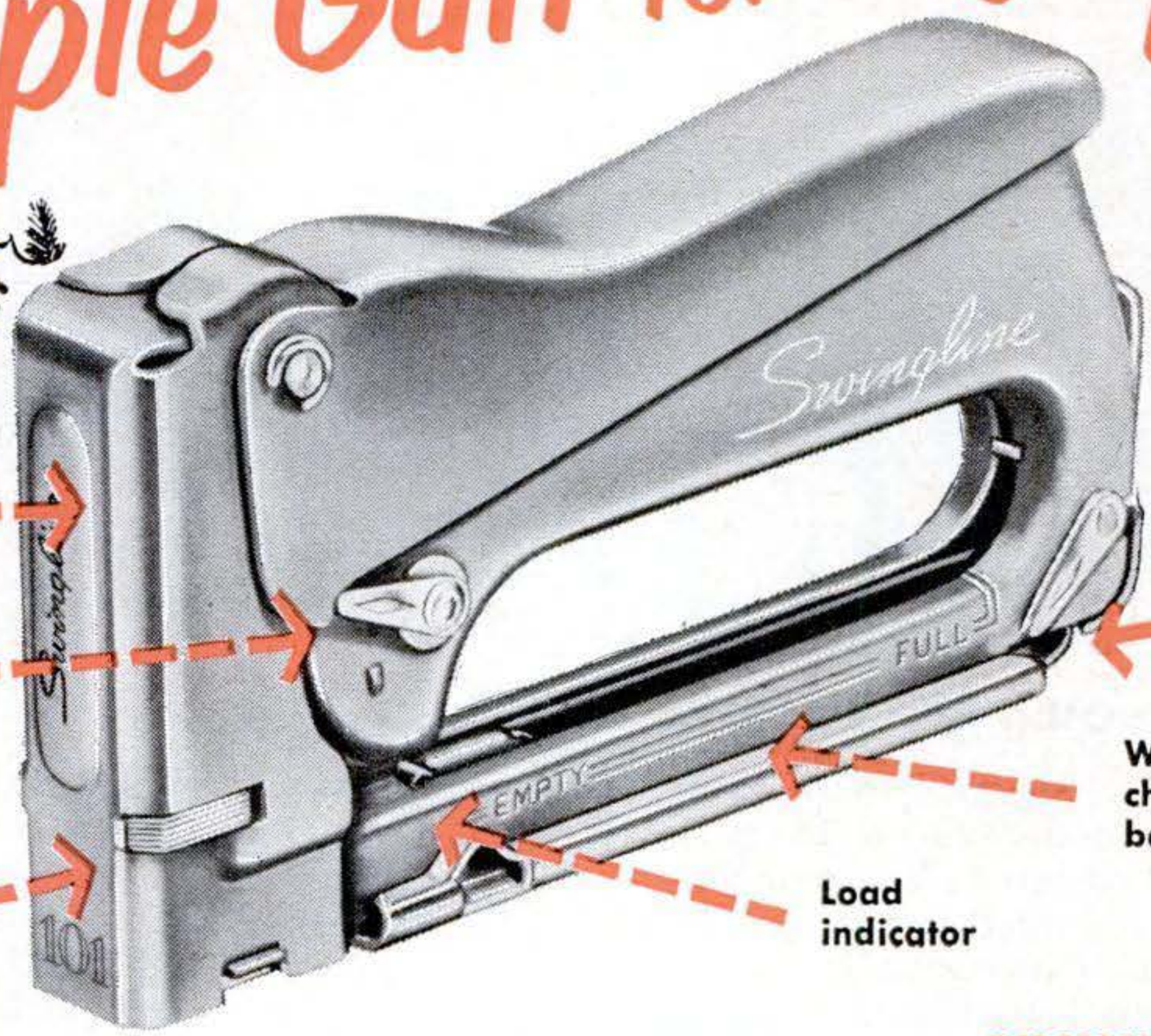
Now! a Swingline hi-compression Staple Gun for only $4.95



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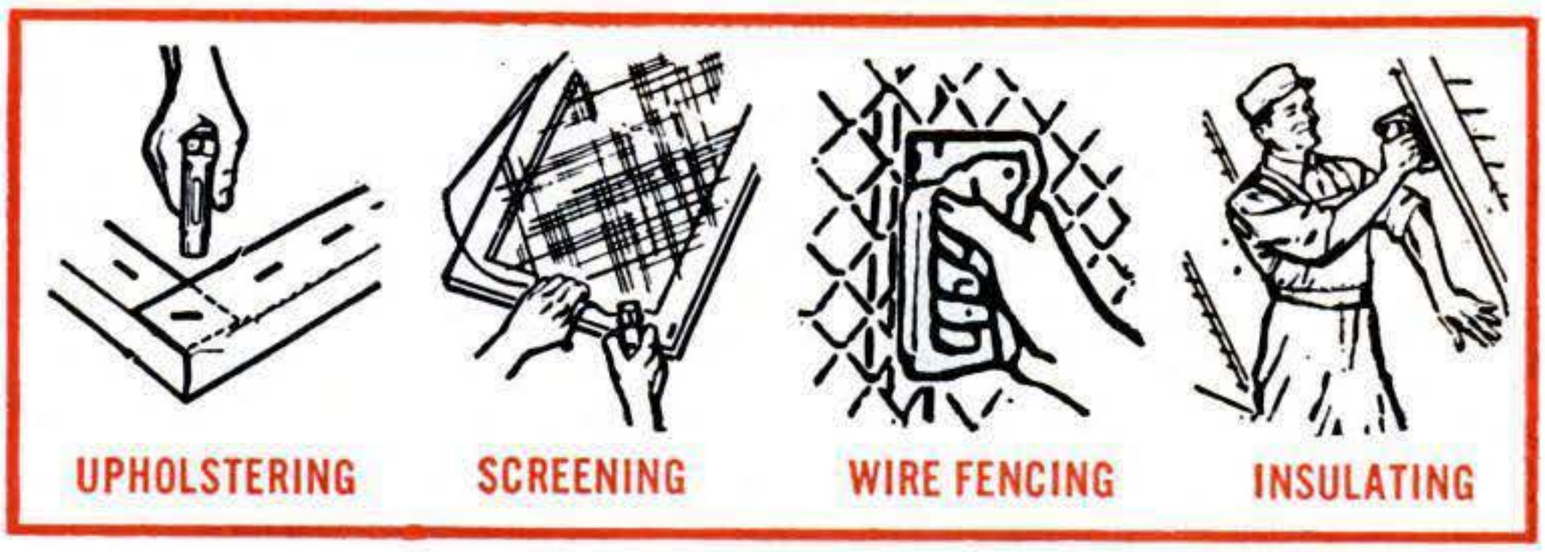

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what's new in hand tools

5 Reversible file, designed for use by right- and left-handers, has teeth made up of many individual hacksaw-like blades that can be slanted either way by turning a knob. The knob also breaks up and releases clogged particles. A two-position handle can be used flat or turned for a plane-type grip. Sold at $8.95 in two types—mill and shell—and in three grades, 14, 18 and 24 teeth per inch. Gordon Associates, Derby, Conn.

6 "Inside-out" monkey wrench has a fixed lower jaw and a movable upper jaw to provide more leverage, because the wrench gets longer as the jaw is opened. Prices: about $2.25 to $4 for sizes from 6″ to 18″. Makers include Trimont Mfg. Co. (model shown), 50 Frank St., Worcester, Mass.; Ridge Tool Co., Elyria, Ohio.

7 First dual-heat soldering gun for the home shop is out this month by Weller, maker of the more expensive industrial types. A trip of the trigger gives you a choice of 90 watts for low-heat jobs or 125 watts. Priced at $7.95 by Weller Electric Corp., Easton, Pa.

8 Four handsome, new, quality hammers. First three from left are Stanley, True-Temper and Estwing—all with high-strength, shimmering steel handles. The fourth is one of 28 hand tools that Plumb is pioneering with tough, resilient fiber-glass handles.

9 Nut-driver set includes five sockets, three screwdriver bits and an extension shaft, all driven by one handle. Western Auto, Kansas City 8, Mo. ($1.25).

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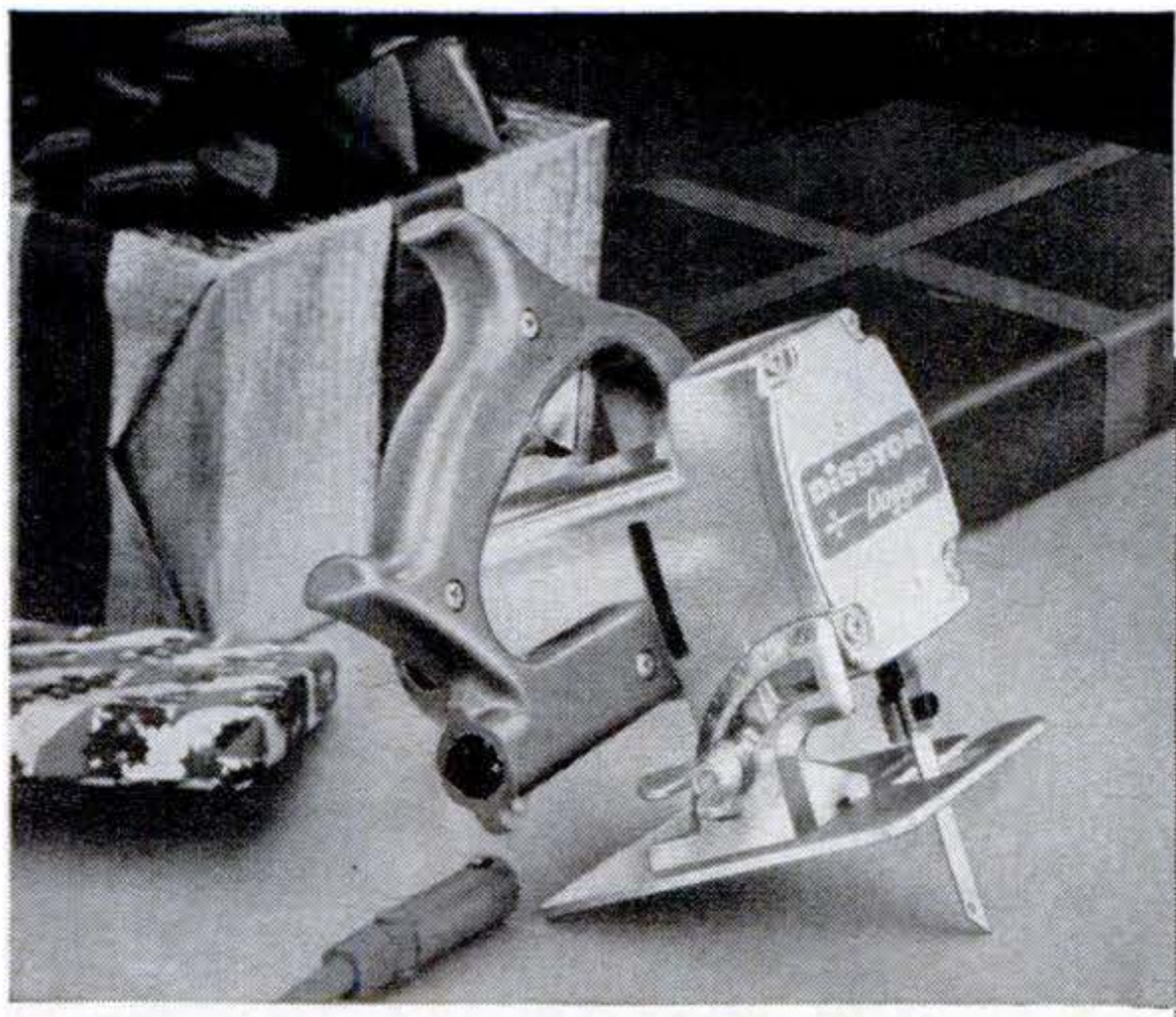
The most exciting gift for a man's man

an all-NEW DISSTON POWER SAW!



DISSTON "Dagger" Sabre Saw — **$54.50** with 10′ 3-wire detachable cord

- **Cuts faster** with exclusive Orbite Action—blade cuts on upstroke, backs away on downstroke. Reduces fraying blade wear, and need for finish sanding.
- **More cutting power**—because it has the highest output horsepower. A 2.75 ampere motor drives it at 3600 strokes per minute.
- **Makes all types of cuts**—rips, crosscuts, bevels, scrolls, and plunge cuts without the need for a drilled hole.
- **Cuts wood, metal, and plastics.** Cuts hardwood 2x4s at 45° angle.
- **A shopful of power saws in one saw**—Disston Dagger Sabre Saw does the work of a jigsaw and bandsaw . . . and even many circular saw jobs.
- **Exclusive** hand saw type handle provides positive handling—more comfortable grip.

These fine new power tools from Disston—offer the most wanted features of much more expensive units. Lightweight and perfectly balanced, they're easy to handle . . . easy to push and easy to lift. And, inside, there's extra power . . . extra capacity.

In addition to these fine power saws, Disston helps simplify your Christmas shopping by offering a full line of home workshop tools: hand saws, small saws, large and small circular saw blades, rules, and many other items.

DISSTON "Discus" Circular Saw — **$54.50** with 10′ 3-wire detachable cord

- **6½″ blade** — cuts 2³⁄₁₆″ at 90°, and 1⅞″ at 45°.
- **10 ampere rating**—2 to 2½ amperes higher than most similar saws.
- **6300 Surface Feet Per Minute**—as much as 1000 S.F.P.M. more than other saws of same diameter.
- **Positive slip clutch** eliminates kickback and minimizes motor burnout.
- **Convenient levers** adjust angle of cut from 0° to 45°.
- **Cutting line always visible**—window in upper guard enables operator to see contact between blade and line on material.

You'll find Disston tools at all leading stores. *Disston Division, H. K. Porter Company, Inc., Philadelphia 35, Pa.*

DISSTON—a world famous name in tools

EXCLUSIVE LIFE-SAVER CORDS provide added safety. These 3-wire cords provide grounded protection. Most important, you can detach the cord from your Disston Power Saw to prevent children from operating the tool.

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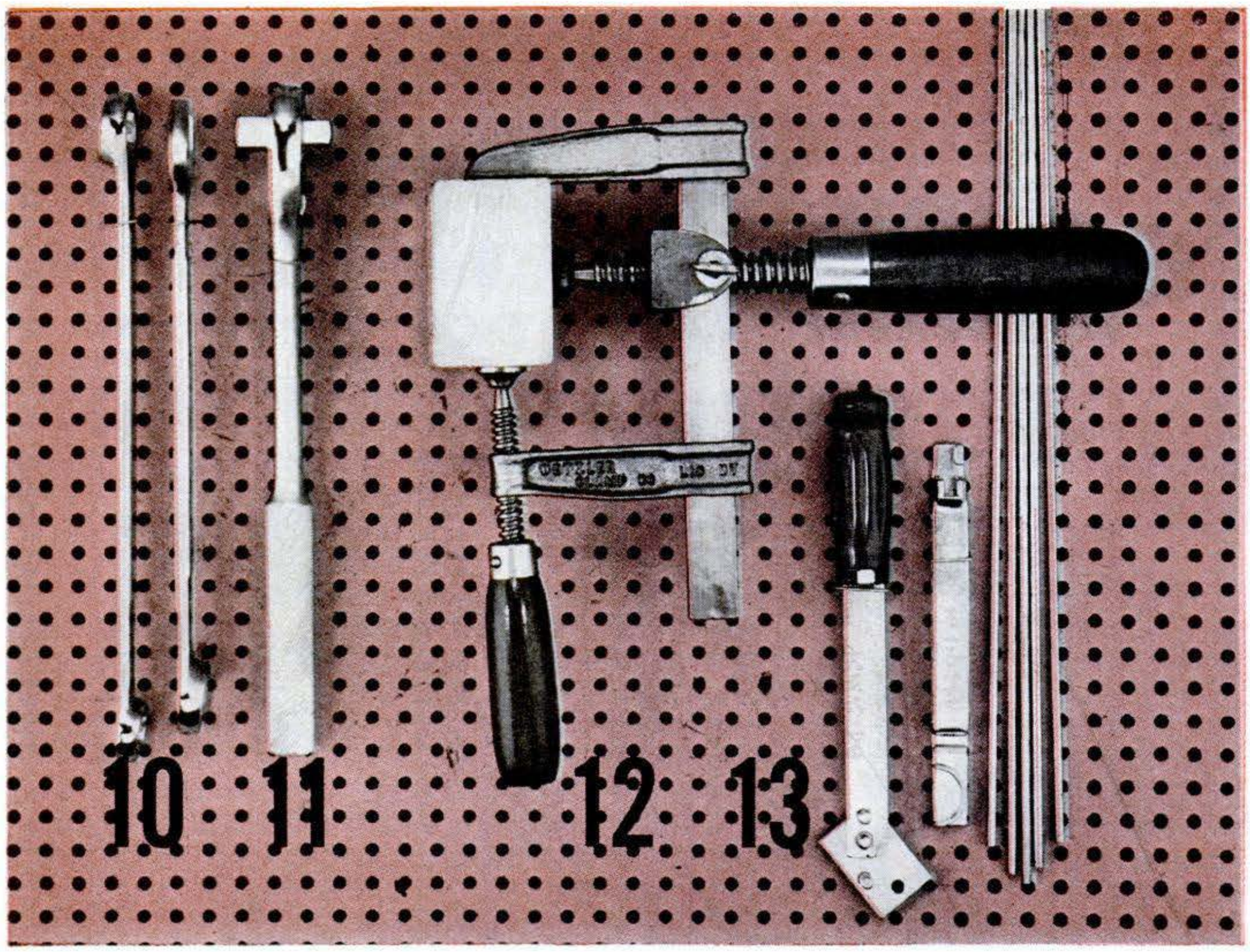
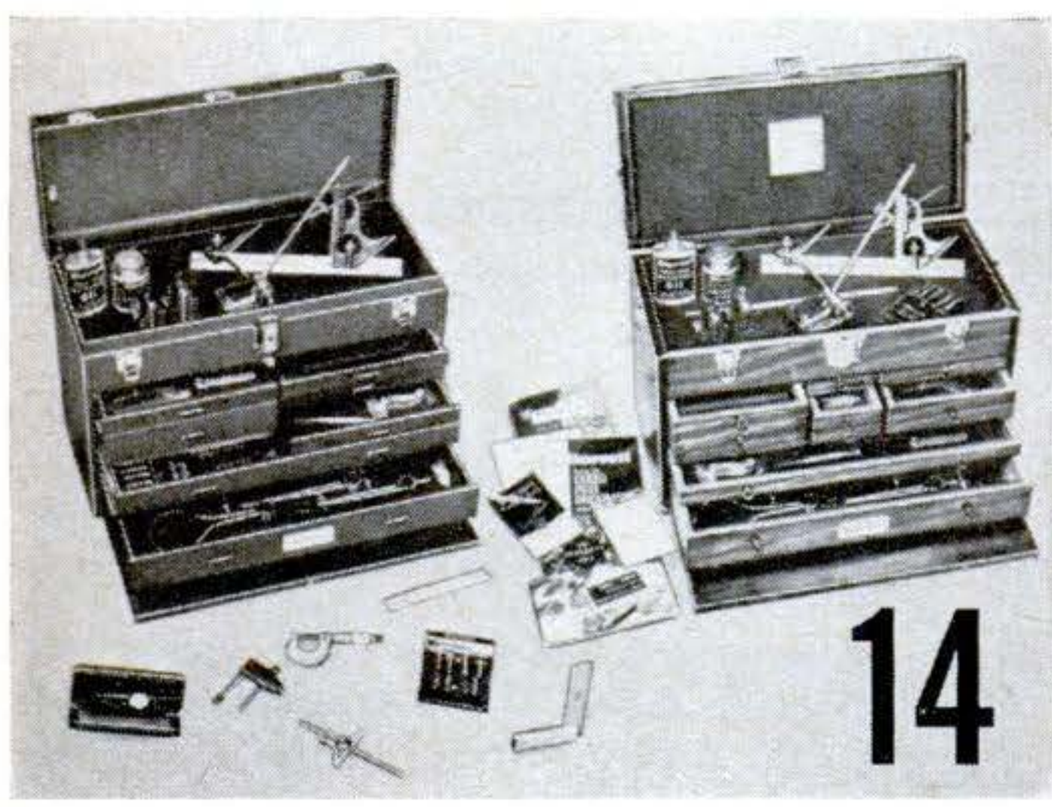


what's new in hand tools

10 **Tapered heads** let this line of box, open-end and combination wrenches work in tight spots. Clearance provided by angling the jaws 15 degrees—instead of tilting the handle or giving it an S-shaped offset—is said to offer better leverage. Taper Design Wrenches are made by the Barcalo Mfg. Co., Buffalo, N.Y.

11 **Double-duty ratchet** offers ½″ and ⅜″ square drives on opposite sides of the head to take sockets for both sizes. It is sold at $6.50 by the Vogel Tool Co., Los Angeles 64.



12 **Cross clamp,** designed to lock on any bar clamp, solves the problem of holding an edge strip in place while glue sets. Made by Wetzler Clamp Co., Long Island City 1, N. Y., it costs $1.85.

13 **Two wire-forming tools** take the effort out of bending wire. The tool with a handle is an all-purpose Wire-former priced at $2.98. Made by the Vinkemulder Co., 917 Princeton Blvd. S.E., Grand Rapids, Mich., it will bend coat-hanger wire and rod up to 5/32″.

The E-Z Bendit is a $1.49 jig with curved guides for bending and crimping hangers for use on perforated hardboard. Ardor Mfg. Co., 611 S. Washington St., Royal Oak, Mich., makes it.

14 **Mechanic's tool chests** are now offered for the first time by L. S. Starrett Co., Athol, Mass., makers of precision tools. They're available in steel ($31.25) or mahogany ($38).

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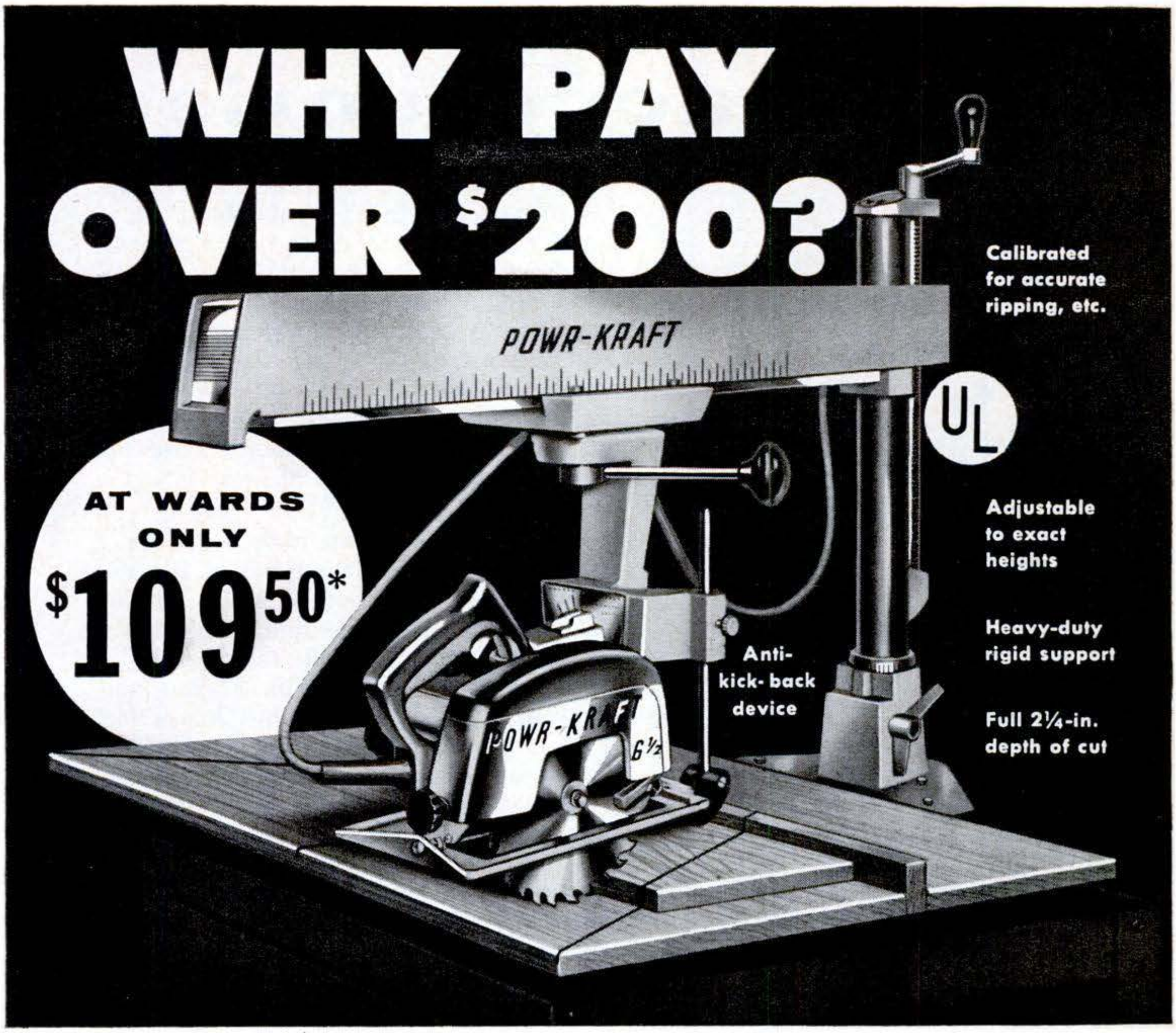

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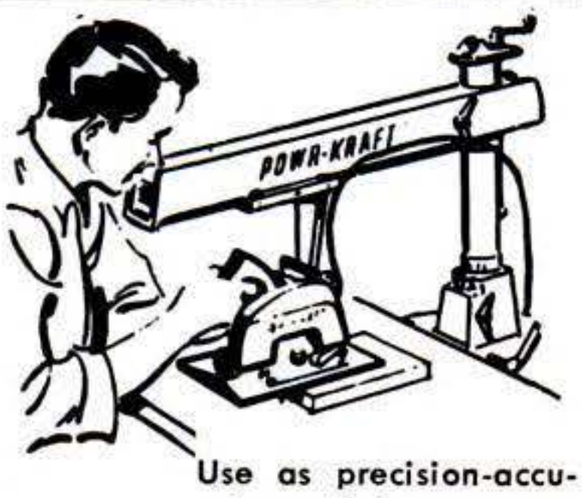

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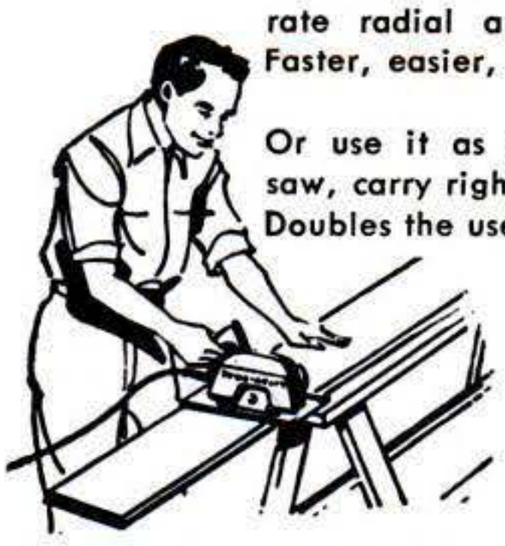

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VERSATILITY. You can crosscut, miter, bevel, dado, make compound miters, even rip to the center of 48-in. plywood! Detach, use as handy portable saw.

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what's new in shop accessories

1 Portable vise. Use this new vise on the workbench with its regular base. Or if you'd rather have a clear bench, use an accessory base (lower right). The pin retracts out of the way. Still another base permits use of the base on a sawhorse. And with an adapter (lower left) you can tilt the vise on all bases. The Will-Burt Co., Orrville, Ohio, sells the vise for $13.95, flush base for $3.90, sawhorse base for $2.75, the adapter for $2.90.

2 Three new sanding pads will hug a flat surface even though you tilt the drill that drives them. Skil's sander (2A) at $4.95 has a flexible shank and a ½"-thick urethane pad faced with a tungsten-carbide disk. The Flexan pad (2B) at $2.98 is similar, but has a ¼" layer of foam and uses sandpaper. Carborundum Co. makes a $7 pad (2C) with a rigid shank. It has a fat ¾" foam pad. Stanley has had an angle-sanding accessory on the market for some time, its Swirlaway, with a ball-joint shank and rubber pad plus polishing bonnet.

3 You dial the drill you need by twisting the cover of this compartmented case. An arrow points to the corresponding tap drill, body drill, thread tap and decimal size. One model holds a set of drills from 1/16" to ½" by 64ths; the other, number drills from 1 to 60. Keystone Ferrule & Nut Co., Burlington, Wis., sells either model for $3.95.

4 Auger bits now come with shanks designed to be cut off. Use them as is in a hand brace. Cut off the taper end, leaving a shank with hex flats (see samples at right), and you can use the bits safely at low speed in ⅜" or ½" electric drills or drill press. Irwin Auger Bit Co., Wilmington, Ohio, makes them.

5 Hex-shaped shanks, instead of round, provide slip-proof boring with spade-type bits made by Greenlee Tool Co., Rockford, Ill. The bits come in 13 sizes from ¼" to 1" for from 60 to 70c apiece.

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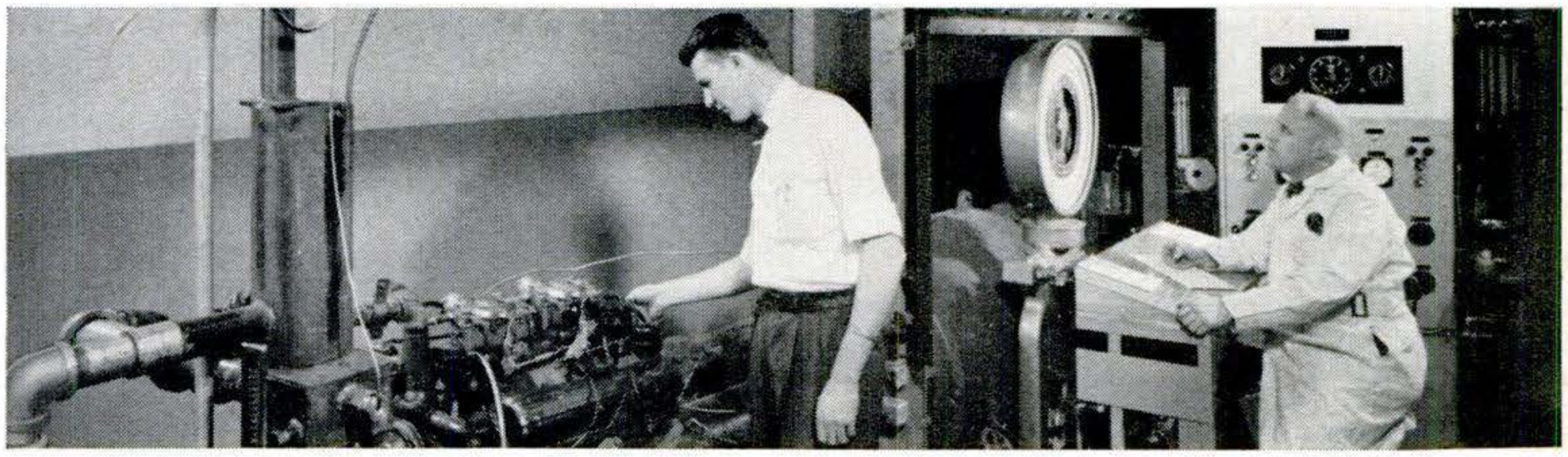
HOW AMERICA'S NUMBER ONE CARBURETOR PUTS A TOUCH OF TOMORROW IN YOUR CAR!



• Dynamometer tests determine the effect of carburetion on maximum power output of a GM car engine. Carburetor design is matched to the specific requirements of each GM engine.

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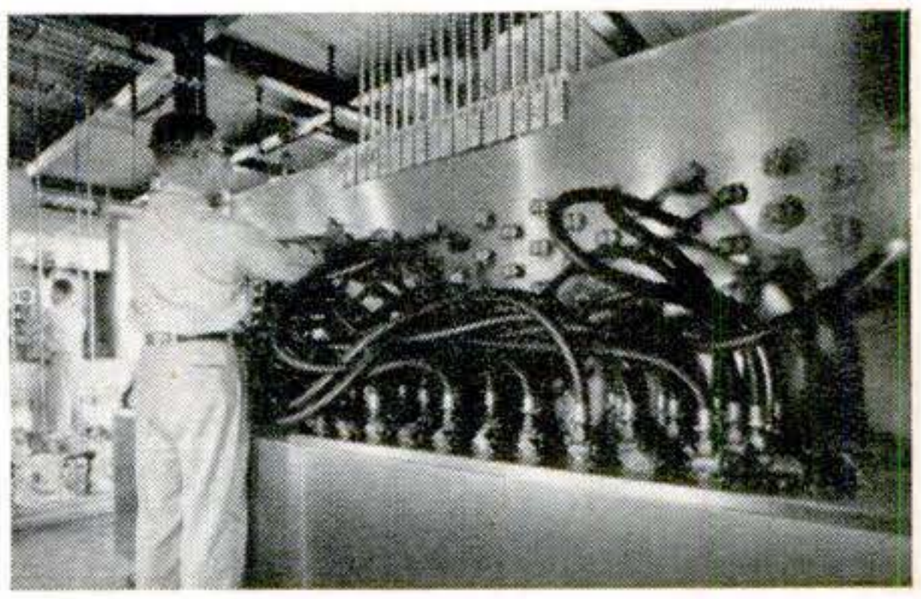

• In the Research Fuel House at GM's Tech Center, seventeen different fuels are tested for operational effects. Result: carburetors designed to get better performance, stricter economy.

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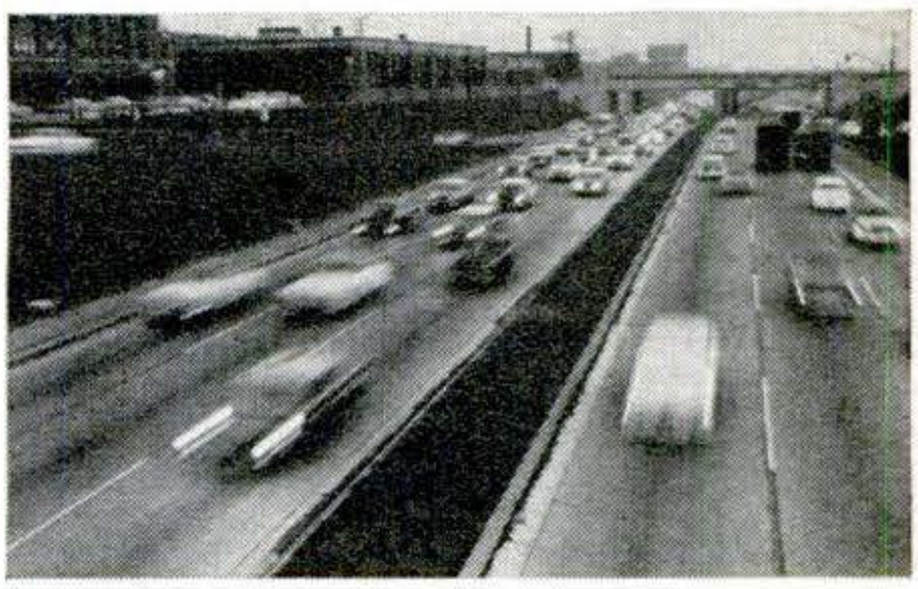

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what's new in shop accessories

6 Portable miter guide reverses standard miterbox operation. You adjust the all-steel Mitre-Master—it weighs only two pounds—for the angle desired. Then you butt it against the work, and with a handsaw slipped in its clip, cut boards and moldings of any angle from 0 to 50 degrees, left or right. Sold for $3.75 by Chesney, Inc., 527 W. Windsor Rd., Glendale 4, Cal.

7 Ratchet and torque-tool attachments both snap onto conventional socket-wrench handles, as shown at left and right, respectively.

With the "Ratchetor," (at left) every type handle becomes a rachet, providing positive engagement every 10½ degrees. Price is in the neighborhood of $7 for a ½"-drive model, and $15 for ¾" drive. The maker is Proto, Los Angeles 54.

The "Torque Tool" makes any handle a torque wrench. It is preset to whatever torque you specify when ordering (from 40 to 180 inch-pounds for a ¼"-drive model, 10 to 30 foot-pounds for ⅜" drive, and 10 to 90 pounds for ½" drive). In use, a release mechanism signals when torque is reached, and resets itself as soon as pressure is eased off. Priced at $9.95 for the ¼" and ⅜" models, and $12.95 for ½" drive, Torque Tools are made by the Milbar Corp., 1900 Euclid Ave., Cleveland, Ohio.

8 You can cut jumbo-size dadoes with this adjustable table-saw accessory. The spiral-cutting bits are simply "dialed" to any width from ¼" up to 13/16" without removing the tool from the saw. The Comet Dial-A-Cut tool will also make cuts up to ¾" deep. It's sold for $19.95 by Comet Mfg. Co., 2033 Santa Fe Ave., Los Angeles. The same manufacturer also has a new 9" radial-arm saw with a one-hp. double-ended motor for driving accessories as well as sawing. The saw has a speed of 3,600 r.p.m. The model F Falcon, it sells for about $239.

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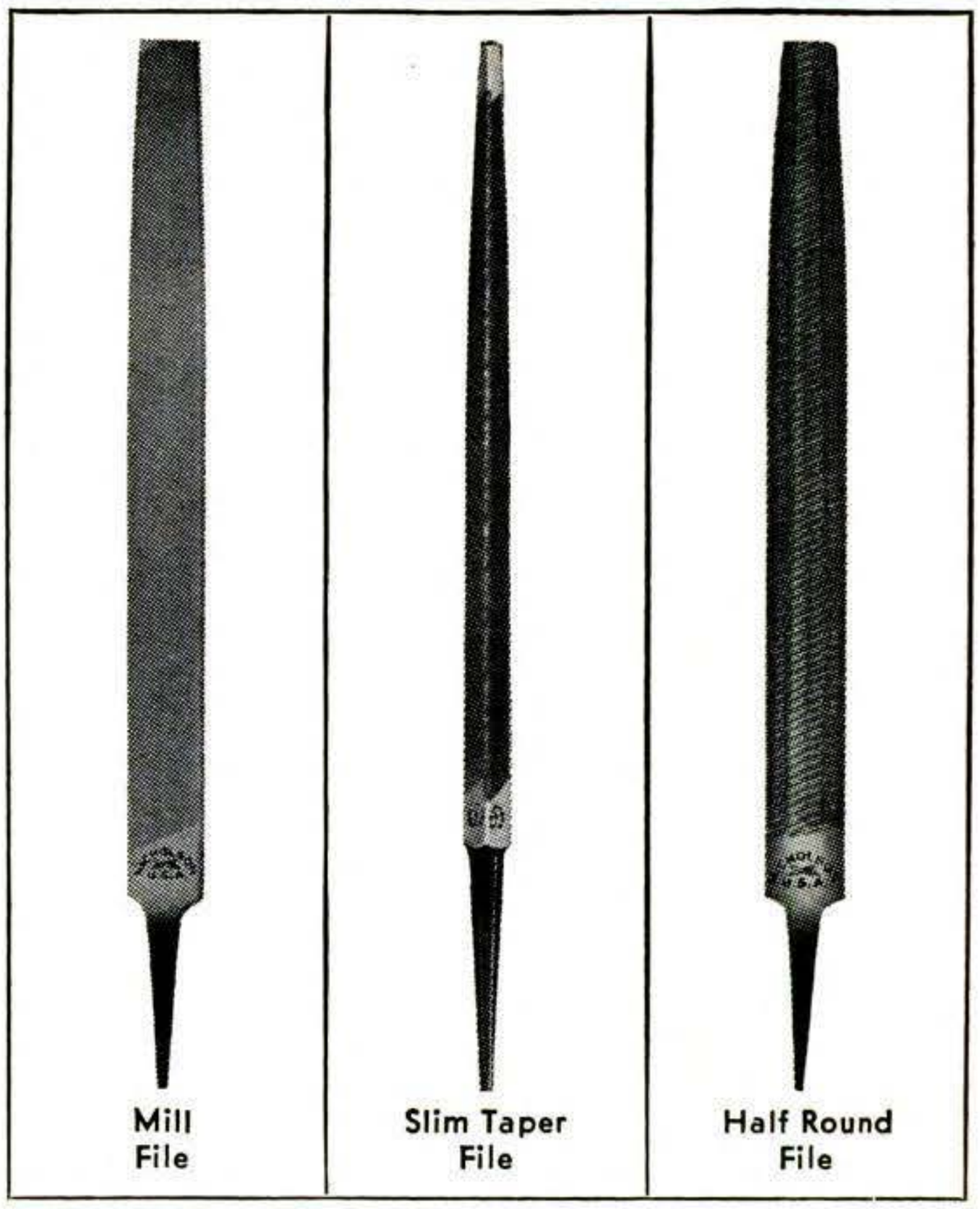

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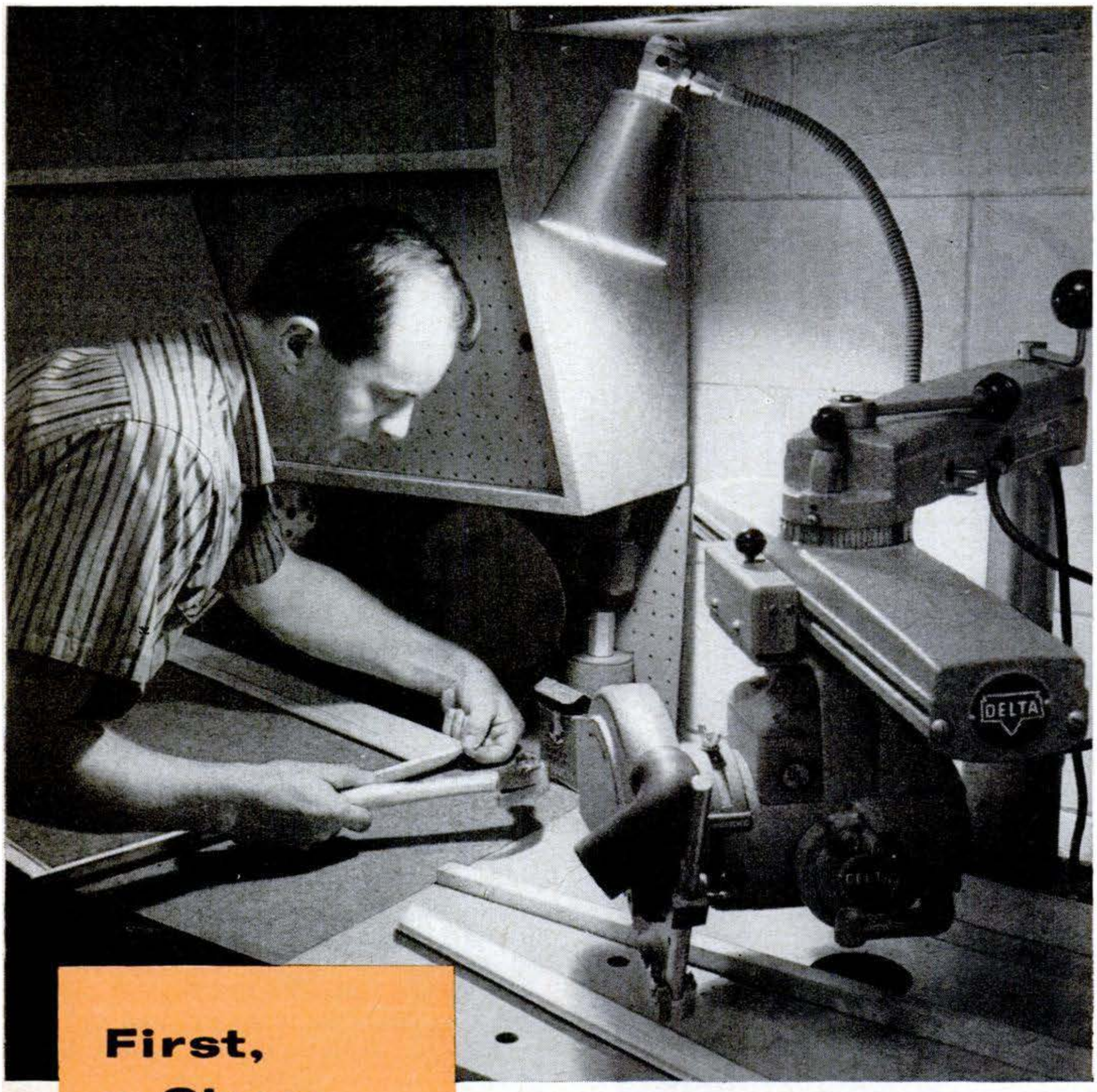
Two Ways of Getting the Most from a Radial Saw



First, a Shop Built Especially for the Saw

By Herbert R. Pfister

TAILORING work areas to fit equipment is an idea that has proven itself in kitchens and built-ins. Delta Power Tool engineers have now carried the idea to the home shop. They have de-

[*Continued on page 176*]

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Home and Shop

Second, a Saw Table with Folding Wings

By Bob Gilmore

I LIKE a flexible shop, with every power tool as mobile as possible so that I can trundle it into the handiest position for any kind of job.

For months after getting my 9″ radial saw and stand (a De Walt Power Shop),

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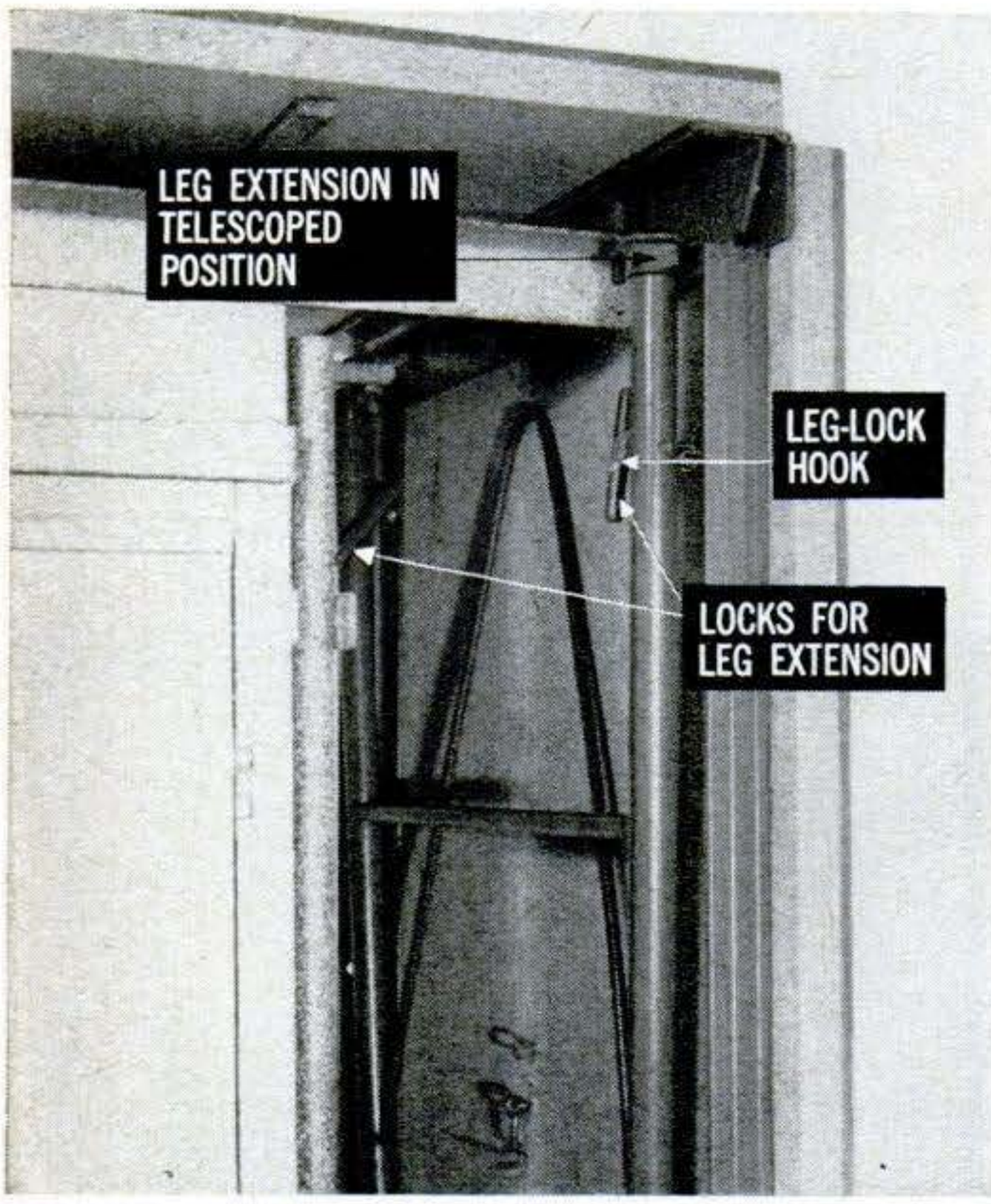
Saw Table with Folding Wings



HOW THE TABLE FOLDS UP: Legs and leg brace pivot upward under each wing. They can be fastened securely in place when you drop the wings to the sides of the saw stand.

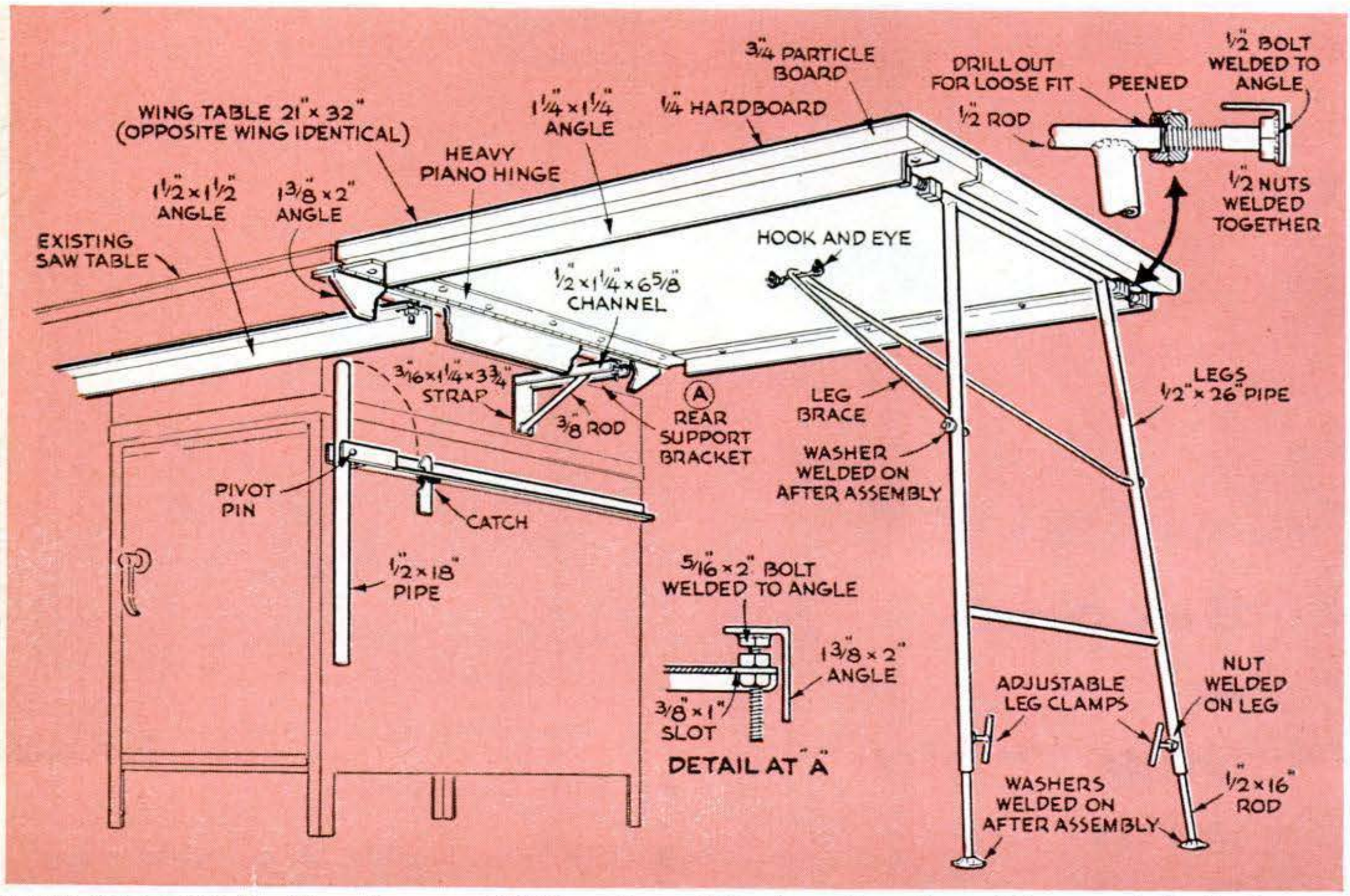
I sketched and crumpled paper, until finally I came up with a workable way to make this new saw best meet my particular needs.

I already had a good workbench, and plenty of shelf and hanging space. So I preferred to put aside the plans for a workbench that came with the tool.

But I did want a table with greater supporting capacity—while still keeping the saw easily movable. And that's what I worked out.

To make the table, I chose ¾″ particle board topped with ¼″ tempered hardboard. I simply tacked the hardboard in place with brads placed where the saw blade couldn't bite them. That way, when the hardboard gets too badly chewed, a clean, new surface will be easy to install.

Next, I made the wings—with the same manufactured-wood sandwich for their tops. They swing up flush with the saw table to make a work surface 8′ long. For their framework, I used lengths of angle, about 1¼″ by 1¼″, from old baby-bed-



MAIN SUPPORTS for the wings are 32″ lengths of 1½″-by-1½″ angle welded across the front of the saw stand, and two angle brackets welded to each side. Bolts welded to the 1⅜″-by-2″ angle beneath hinges can be adjusted for height when attached to supports. Handles, ½″ pipe pivoted at sides, are held horizontal by catches that also permit downward control of handles if saw should tip back too far while rolling. If there's no welding shop handy, much of the assembly can be bolted together, especially parts attached to the stand.

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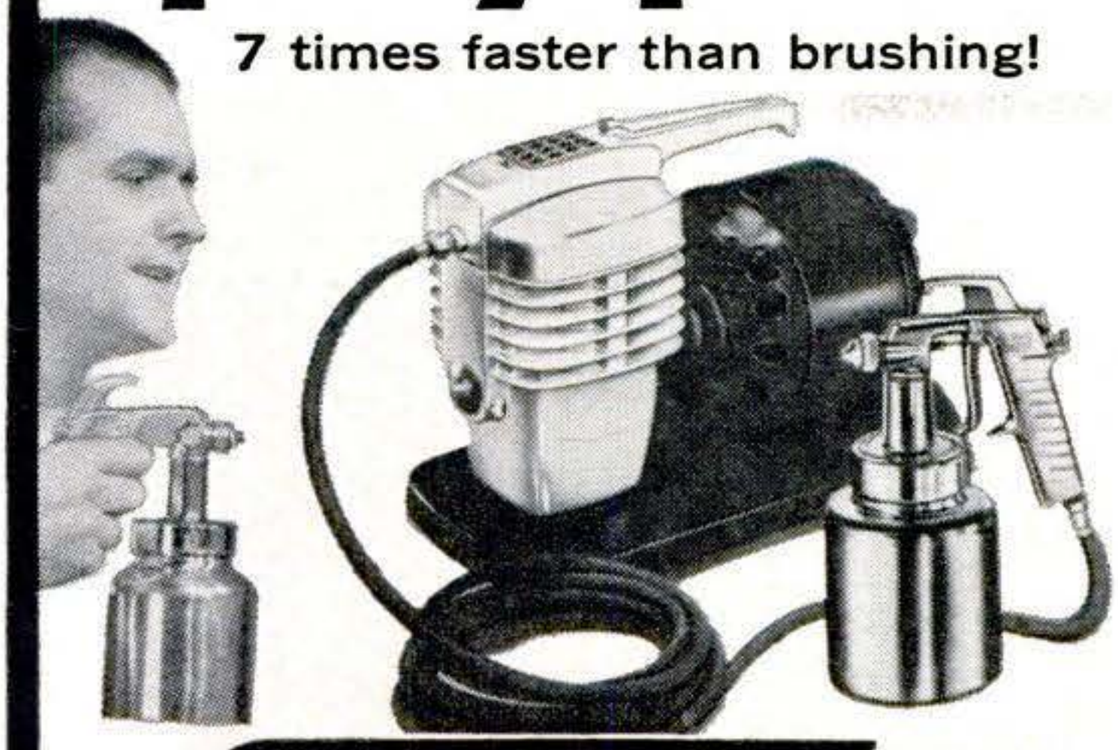

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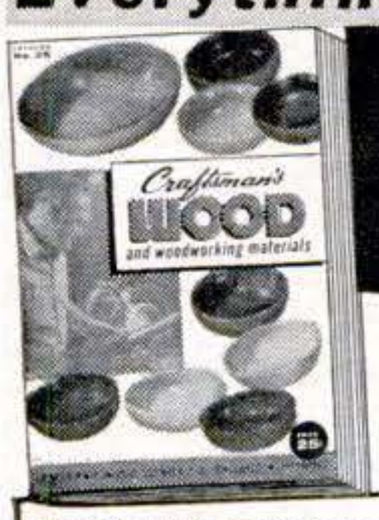

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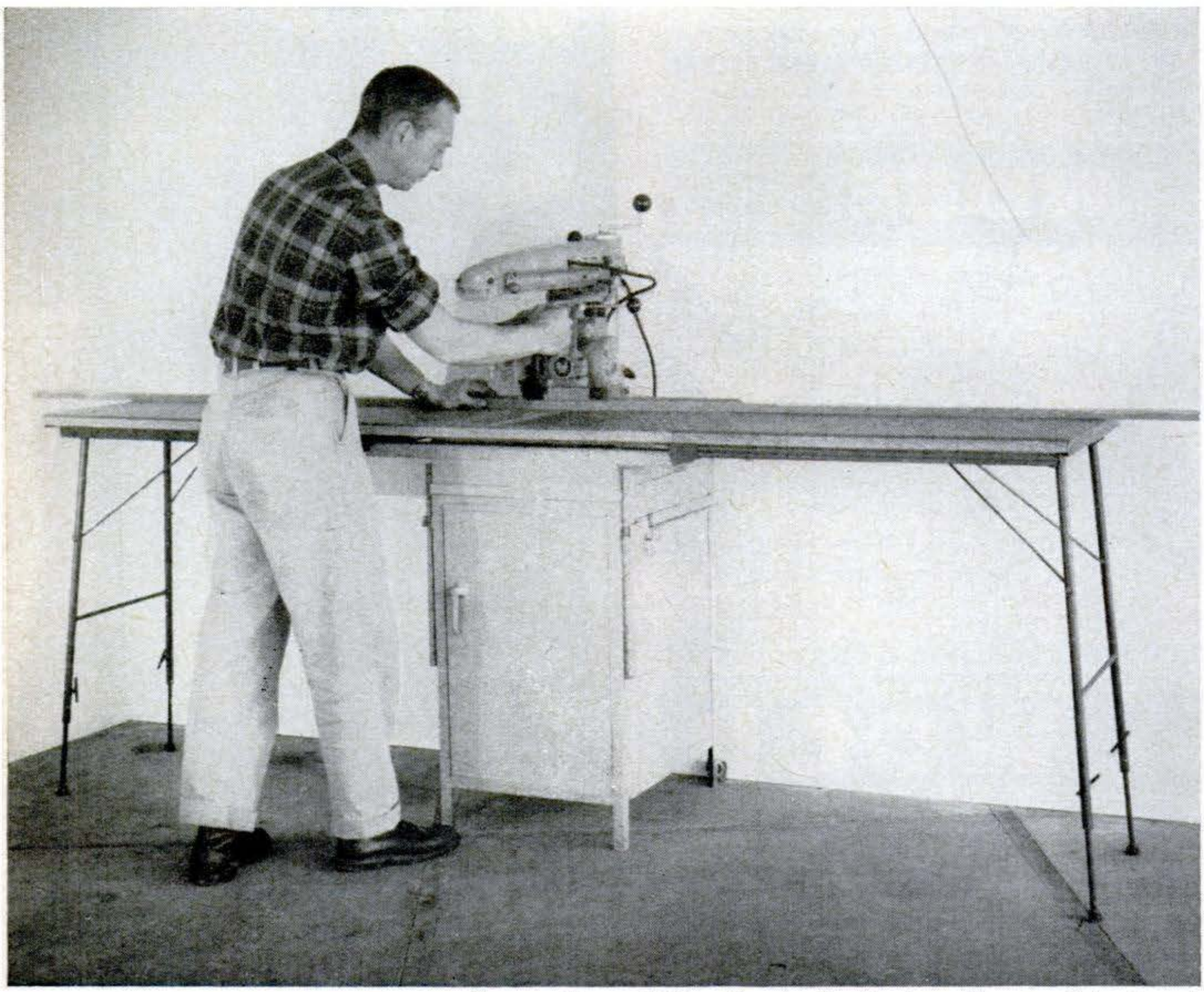
spring frames. Hinges are the piano type, wide and heavy. The folding legs are ½" pipe, with ½"-rod extensions that telescope to make 36" table height possible even though they must fold into a shorter space. Because the legs are adjustable, the most uneven floor presents no problem; they reach into the low spots.

For easy mobility, I welded heavy steel-wheeled casters just off the floor on the back legs of the saw stand. The legs rest solidly on the floor until the stand is tipped back a little. Then the casters take over for moving it around.

To maneuver the saw about, I made wheelbarrow-like handles of ½" pipe. They're pivoted to drop out of the way, yet they catch and hold firmly in the horizontal position by safety locks of strap steel.

Welding and work scars on the stand were concealed with spatter-tone paint to match the factory job.

ONE of the newest types of home-shop tools, the radial-arm saw is difficult to pass by if you are buying a saw. Major makers of home-type radials are Comet Mfg., 2033 Santa Fe, Los Angeles; Delta Power Tool Division, Pittsburgh; De Walt, Inc., Lancaster, Pa.; Hendrick Mfg., 11 Selman St., Marblehead, Mass.; Sears, Roebuck, Chicago; Skil Corp., Chicago; J. D. Wallace, 800 N. Detroit St., Warsaw, Ind.



WITH WINGS UP IN POSITION, you have all the support you need for sawing large panels and long pieces of lumber. Welded-on casters, which take the load when the stand is tipped back for moving, are visible on the rear legs of the saw stand near the floor. END

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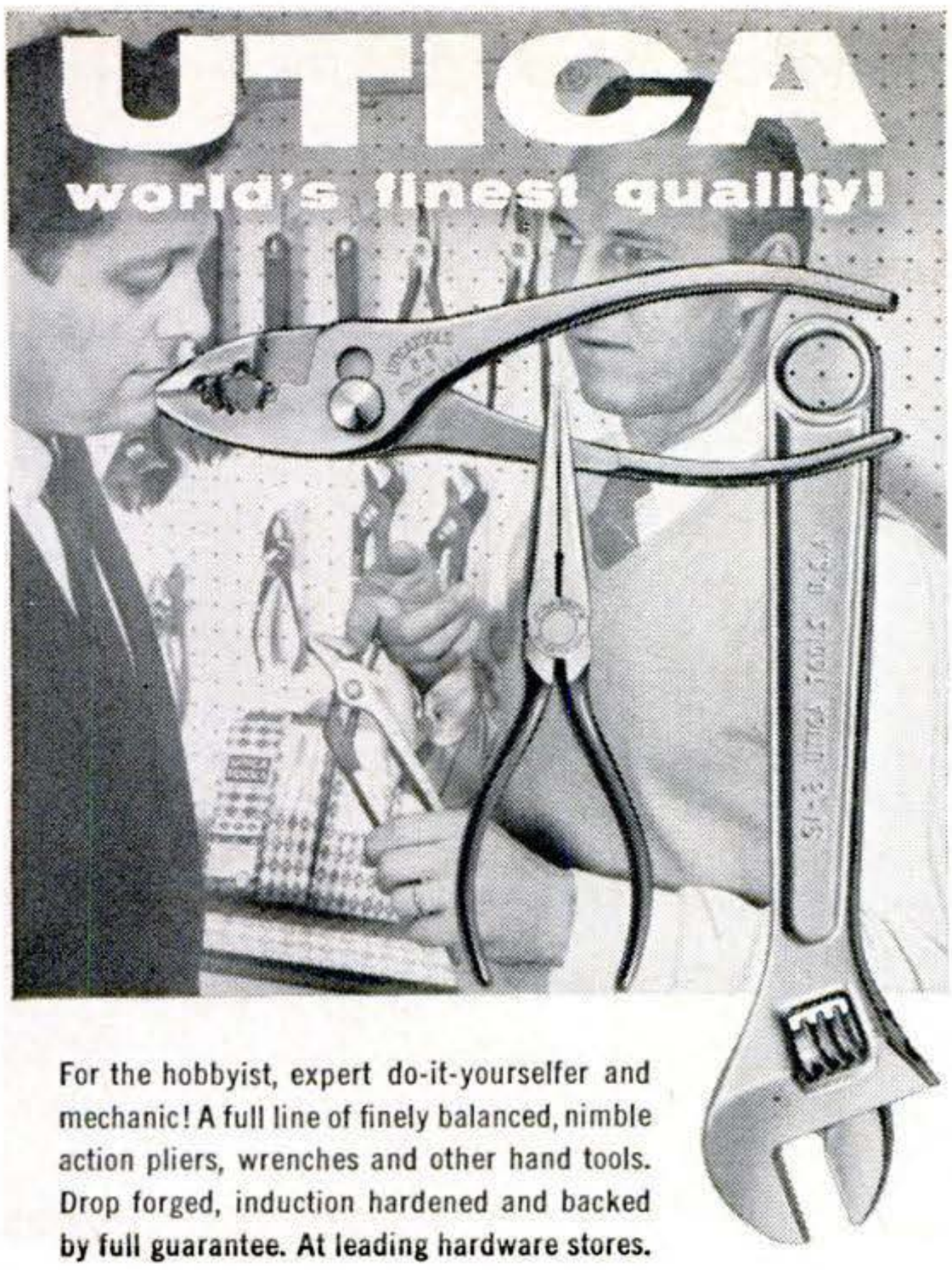

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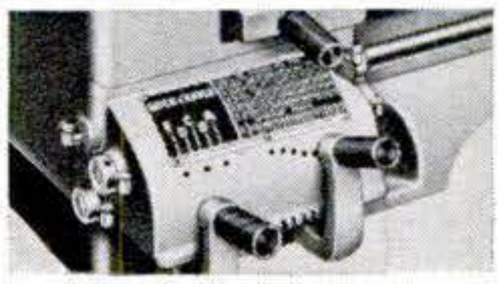

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Shop Built Especially for the Saw

[*Continued from page 170*]

signed and built a shop around the company's "900" radial saw to help users get the most out of the saw. Occupying a 9′ stretch of wall, the shop is adaptable to most home garages or a corner of the basement.

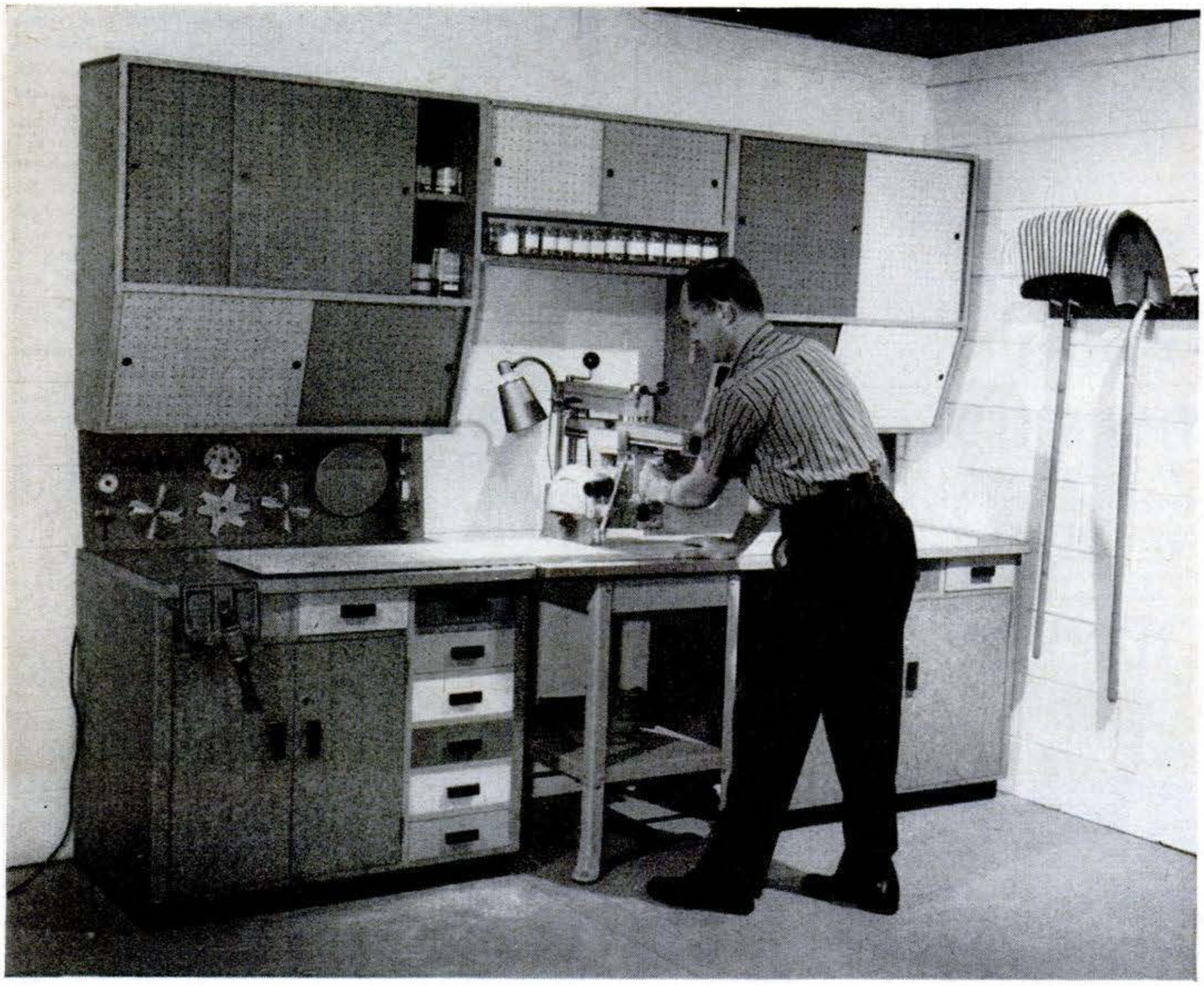
Fitted into an opening between twin workbenches, the saw in effect becomes a part of one long bench. The benches are precisely the height of the saw table. They serve as outriggers to support the overhang when you cut long boards. You can make most cuts with the saw in place, but it quickly rolls out for bigger work. Retractable casters are available for the 900. They bolt on the legs.

Perforated-hardboard backboards above the rear of each bench support accessories and extra blades within easy reach of the saw. A gooseneck saw light can be swung from side to side when the saw isn't being used, to illuminate either workbench.

Cabinets with sliding doors are fastened to the wall above the benches and the saw for storing paints, screws and miscellaneous shop items. Slanting fronts on the lower parts of the cabinets permit you to work at the benches or lean over the saw without bumping your head.

The sliding doors are perforated for ventilation where paint is stored. They are installed in grooves with no special hardware or tracks. Shelves are adjustable by pressing their supporting dowels into the most convenient of vertical rows of holes drilled in the cabinet ends.

As built by Delta, the shop occupies a floor space 27″ deep and 9′ long, but you can easily suit your own needs by changing the plans—available free from Delta Power Tool Div., Rockwell Mfg. Co., Dept. 3, Pittsburgh.



GARAGE IS AN IDEAL SPOT for this Delta workshop if you have a few feet of space in front of the car. With the car out, you can pull saw into the open for ripping long boards. END

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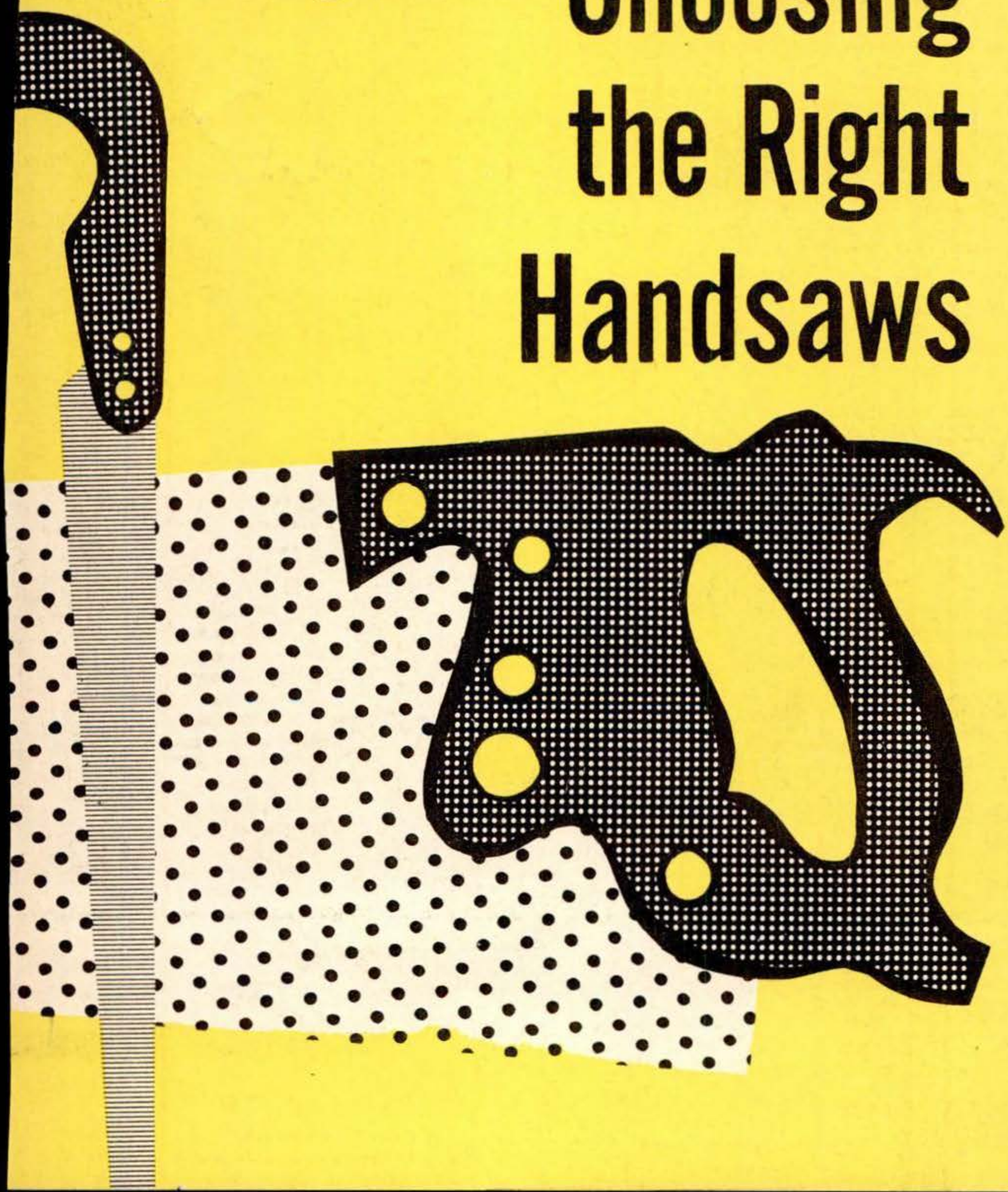
Home Owner's Money-Saving Guide to

Choosing the Right Handsaws



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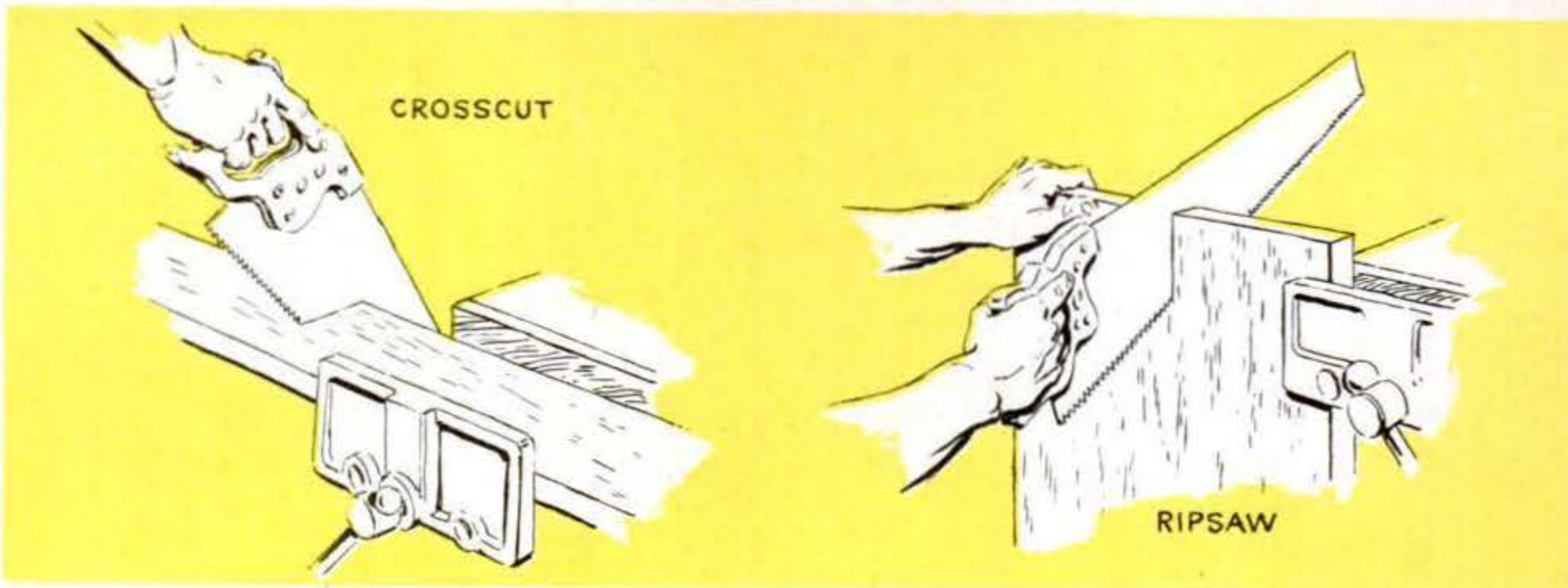
What to look for when you buy



THE most important handsaws in any home owner's tool kit are a crosscut saw and a ripsaw. A crosscut saw is designed to slice smoothly through a board or timber *across* the grain. A ripsaw, with its coarser teeth, does a much faster job of cutting *with* the grain. If your tool budget is limited, buy a crosscut saw first. It will double reasonably well as a ripsaw. But a ripsaw does a very poor job of crosscutting.

When you buy either a ripsaw or a crosscut saw, bear these general points in mind:

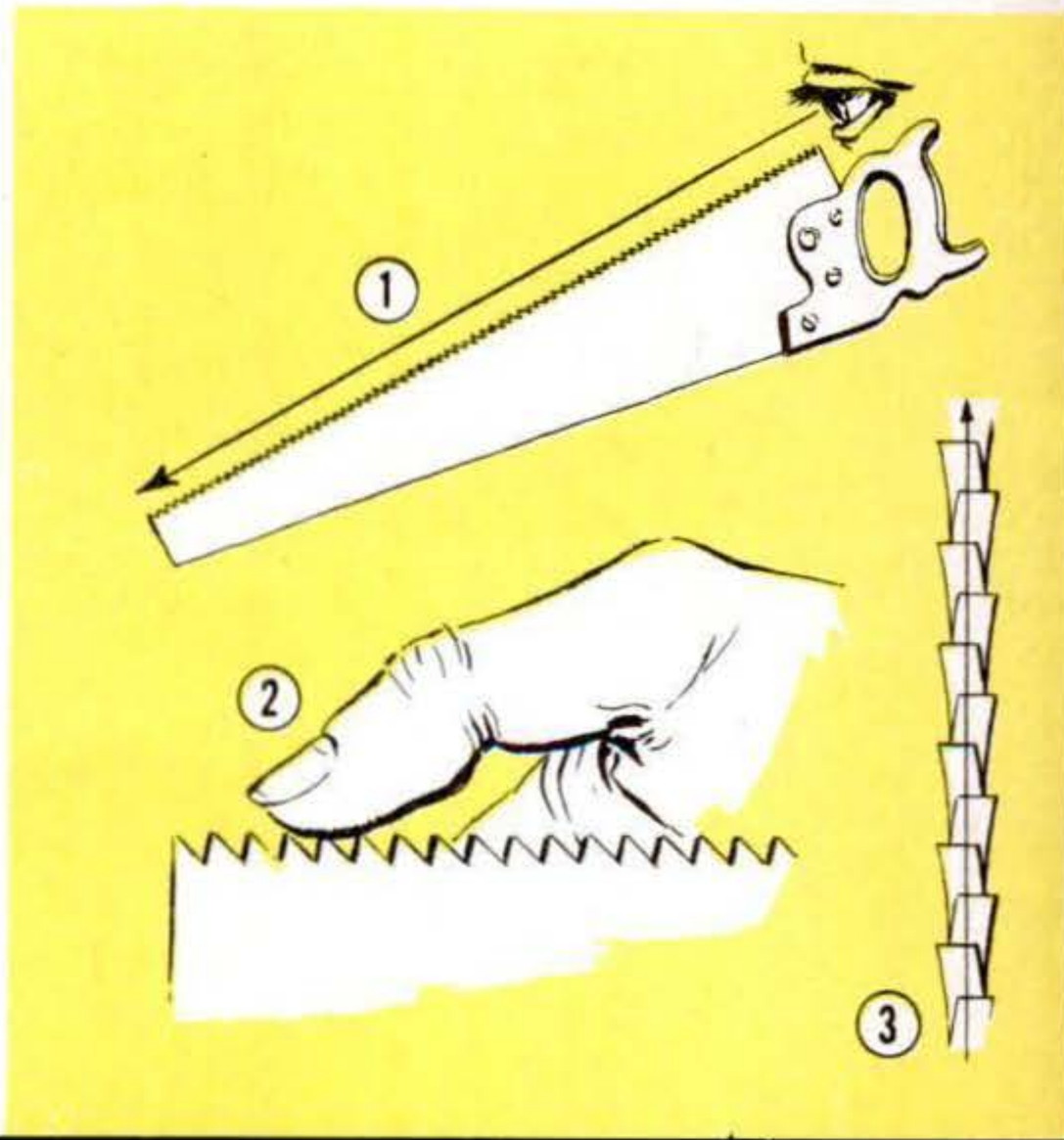
Length. Most experts recommend 24″ or 26″ for basic saws of both types. Shorter blades are sometimes handy, but they require more strokes for a cut of given length, and may tire you out faster.

Balance. Be sure to get the "feel" of a saw. This can't be measured by any general test. Heft it and swing it around a bit, making sawing motions in the air. The best saw for the other fellow may not be the one for you.

Workmanship. Look for a good finishing job on the blade and handle—the best external evidence of good workmanship. This test alone should give you the tip-off on those stamped-out "bargain" saws that couldn't cut their way through chilled axle grease.

Getting down to the finer points, make sure that a crosscut saw or ripsaw checks out with the following questionnaire:

1. Is it straight? Hold the saw with teeth up, blade away from you, and sight along it. It should be absolutely straight from handle to tip. Even a slight bend or bow will cause it to



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a crosscut or ripsaw

bind and jam every time you use it.

2. Is it sharp? Run your finger lightly over the teeth. They should catch the skin with little tugs.

3. Are the teeth set evenly? Squint from the back of the saw toward the teeth. On a properly dressed saw (one that has had the sides of its teeth filed lightly) none should stick out farther than the rest. If any teeth project too far, they will drag and leave a rough-edged cut. If all of the teeth on one side of the saw are set out farther than those on the other side, the blade will twist and won't cut square.

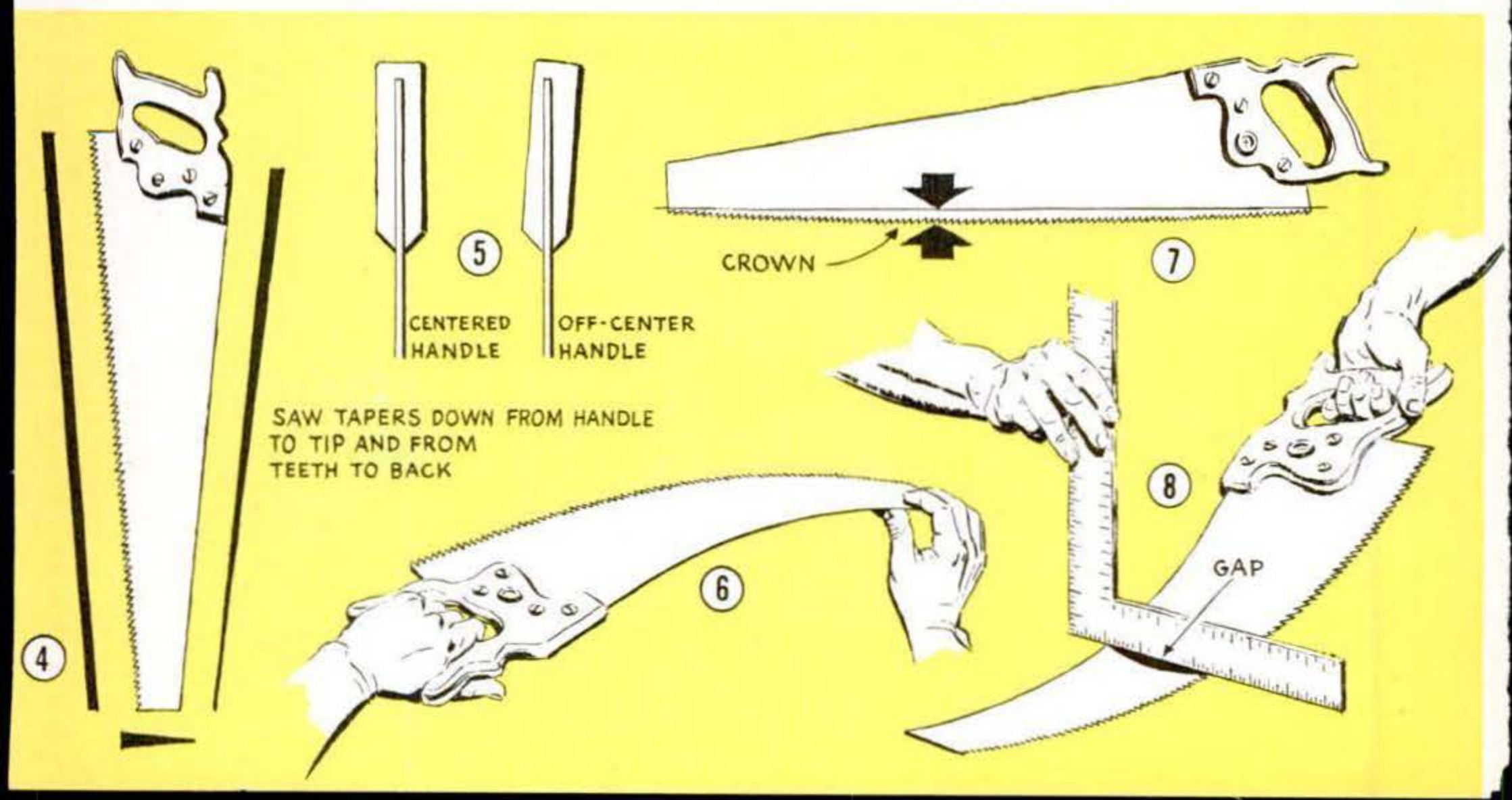
4. Does the blade taper? A taper-ground, or hollow-ground, saw is thinner at the back than at the teeth, providing free-running clearance because the teeth don't have to be set out so far. Taper may not be visible to the eye, so make sure it is specified by the manufacturer. Beware of saws that are just dubbed off at the back to give the appearance of taper.

5. Is the handle straight? Make sure that the blade-holding slot in the handle is centered and true. A crooked handle throws your arm off center, making sawing inaccurate and tiring.

6. Does it flex easily? The blade should flex easily when you bend it, then snap back quickly to a firm, straight position. A blade that whips too much may be hard to control.

7. Is it crowned? Hold the saw at arm's length and sight along the cutting edge. You should see a slight outward curve of the teeth at the center of the blade—about 1/8″ in 26″. This crown is designed to put greater pressure on the teeth by having only a few contact the work at once. In general, a high-crowned blade is best.

8. Is the tension right? Saw blades are rolled and hammered along the



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center portion to provide a built-in tension that keeps the blade straight and balanced. Bend the saw, set a straight edge across the concave face of the blade at its center, and you'll see that the metal has bowed (this bow tries to spring the blade back straight). If the gap made by the bow is uniform, the tension is right. If it's lopsided, you'd better pick out another saw.

While these specific checks apply principally to ripsaws and crosscut saws, a number of them can be used to determine the quality of other types of handsaws.

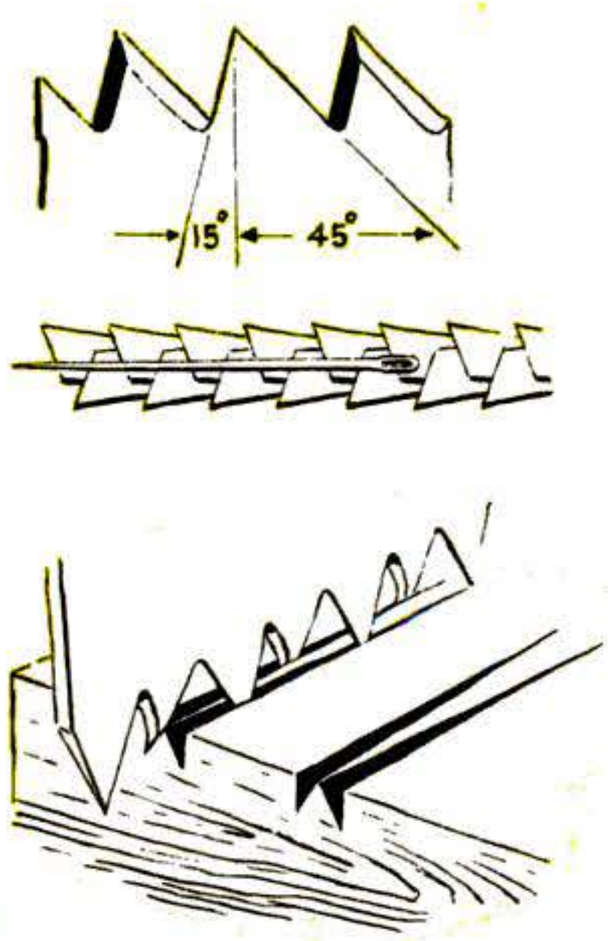
How to choose a crosscut saw

IF YOU'RE buying a crosscut saw, the uses to which you'll put it should determine its length and the number of points. These saws come from 16″ to 26″ long, and offer ranges of from seven to 11 points.

If you're looking for a dual-purpose first saw, a good choice is a 24″ or 26″, eight-point job. While it won't leave edges as smooth as a 10 or 11 pointer, it's a good fast crosscutter, especially useful when sawing green wood. It will also rip reasonably well. On the other hand, if you're going to team a crosscut saw and a ripsaw right at the start, you'll probably prefer a 26-incher with 10 or 11 points.

The shorter crosscut saws (those between 16″ and 24″) are fine if you never tackle any heavy work. And the little 16-incher *(tool-box saw)* is handy as an auxiliary—one you can stow in your luggage easily for sawing tasks at a camp or cabin.

Take a look at the cutting edges of a crosscut saw's teeth. You'll see that they are inclined, and bevel-filed at about 24 degrees, to make a slicing cut like knives across the grain of the stock. They first score, and then begin paring the slot so formed. Sight along the top of the teeth and you'll notice a V groove down the center. If the saw has been properly set and filed, that groove should be so straight you could slide a needle through it.



The right way to crosscut. For best control, start cuts with the teeth nearest the handle. Once under way, hold the saw at an angle of about 45 degrees. Stroke slowly and evenly, using as much of the blade as possible. If the grain makes the blade try to crawl to one side, counteract this by giving the handle a slight reverse twist. Never force the blade or you'll work harder than necessary, produce a rough cut, and waver from the line. To control a natural tendency to angle the blade away from perpendicular, hold your elbow close to your body. This rule applies to ripsawing, too.

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How to choose a ripsaw

THE most common ripsaw—and probably the best for you—is 26″ long and has 5½ points. If the number of points isn't specified, here's how to tell: Measure from the point of one tooth a distance of 1″ and count the points, including those at both ends. Actually, then, you'll find that a 5½-point saw has only 4½ points to the inch.

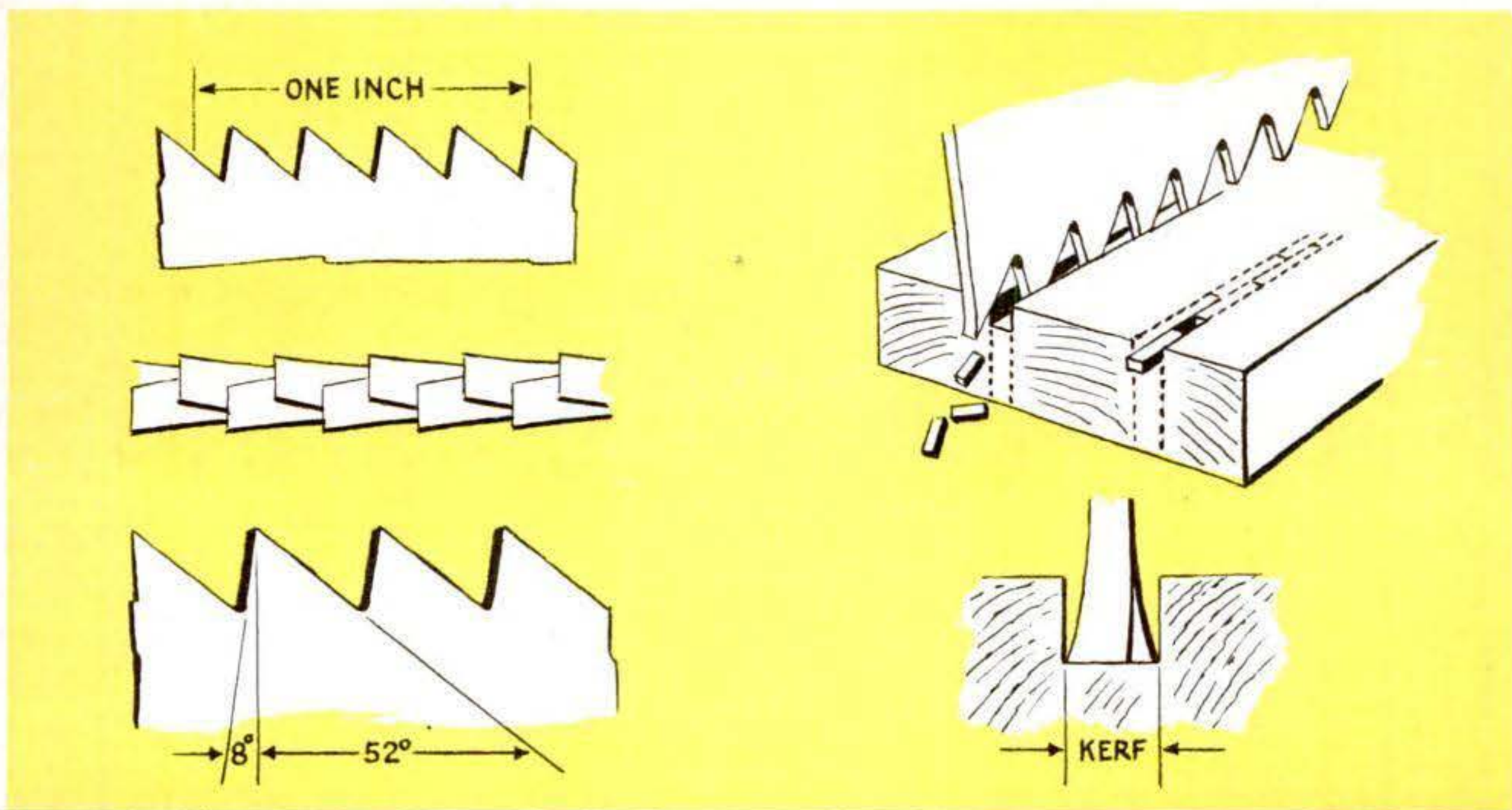
The cutting edges of a ripsaw's teeth should be almost perpendicular to the saw and filed straight across the face. They should also be bent to the left and right, alternately, about one-third of their thickness. This makes them look and act like so many tiny, vertical chisels. As the saw is stroked forward they chip small pieces of wood loose, first on one side and then on the other, and force them out of the front end of the kerf.

On a good many ripsaws, the teeth at the forward end are cut one point finer than the rest. This is a convenient feature. By making a few short draw strokes with them, you can start the cut more easily.

The right way to ripsaw. Start cuts with the forward part of the blade. For most ripping, hold the saw at an angle of about 60 degrees to the wood. Lower it to 45 degrees for smoother cuts in thin stock or plywood.

In ripsawing, you may find that arcing the blade in a vertical plane is easier than stroking it straight. Carpenters who use this arcing method claim that it is better suited to the mechanics of the human arm and shoulder. Some experts even recommend an exaggerated arc for sawing thick lumber, especially hardwood. Under these conditions, arcing is like shifting into low gear. Fewer teeth cut at any one instant, but the strokes go more easily.

If you use saw horses when ripping, place them wide apart and always make cuts outside them to prevent binding. If the kerf closes behind a ripsaw, squeezing down and binding the blade, don't fight it. Just drive a wooden wedge or large screwdriver into the forward end of the cut to widen it and hold it open.



The handsaw that makes

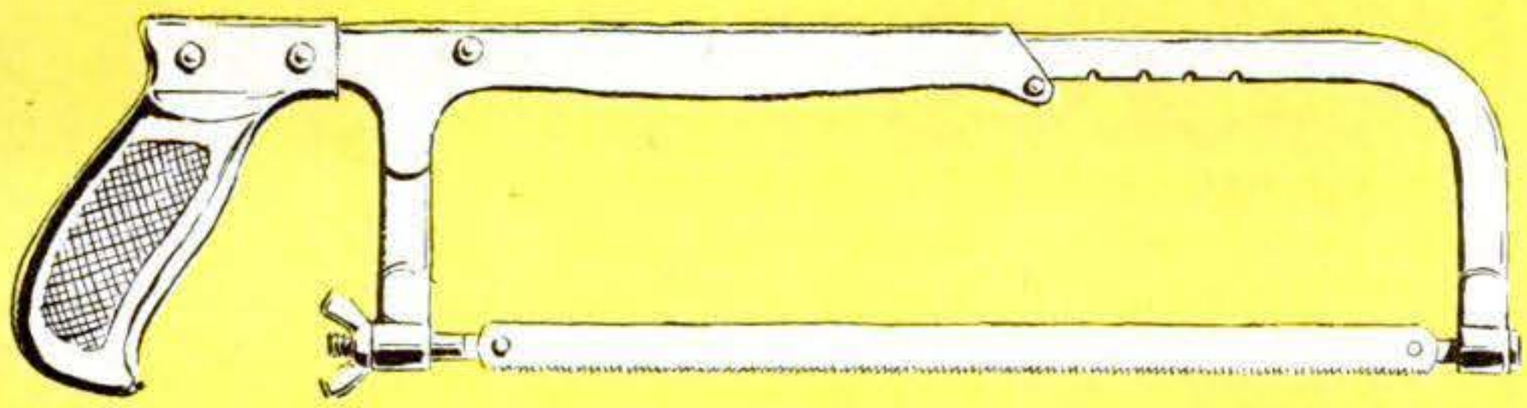
BECAUSE you can replace a hacksaw blade whenever it wears out, and interchange all types of blades for various cutting operations, a hacksaw frame can be a lifetime investment. Choose it carefully and it will be.

Frames come in a variety of types. They range from a little close-quarters model bent from a single steel rod, and a simple handle that holds blades unsupported like a saber saw, to a big double-blade job that gives you your choice of coarse or fine teeth with a flip of the handle.

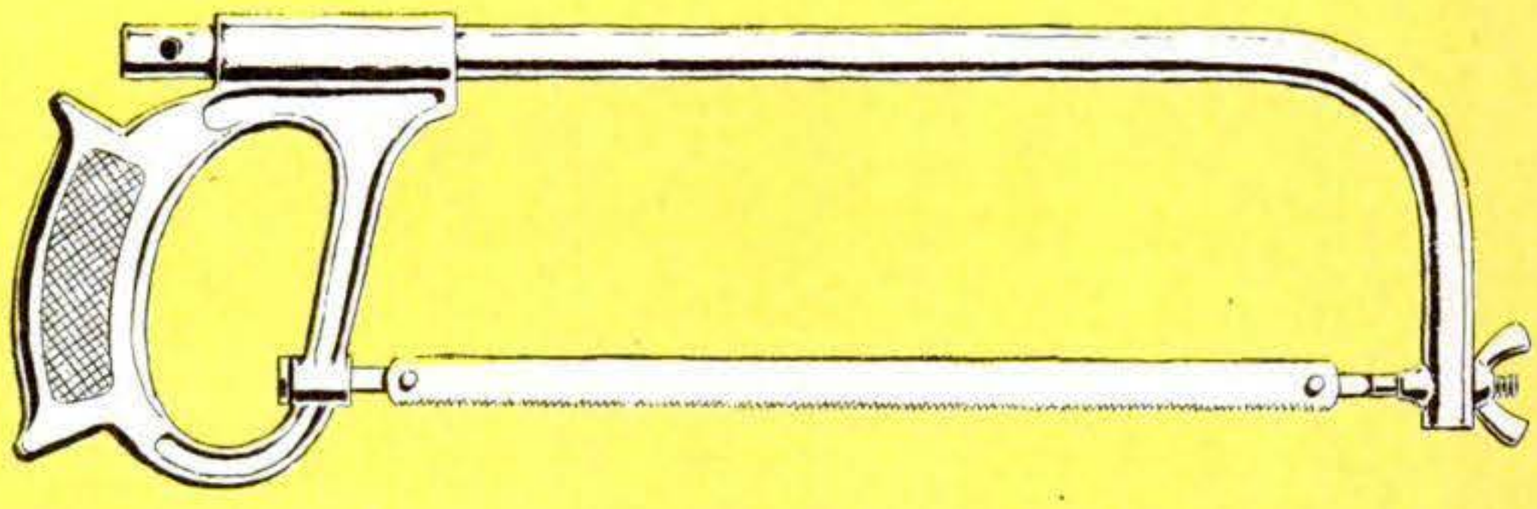
The close-quarters and frameless-handle saws may prove useful as secondary tools, and if you do a great deal of hacksawing it might pay you to have that double-blade model. But for 99 out of 100 metal-cutting jobs, your best bet is a conventional U-shaped frame with a comfortable pistol-grip handle. Select one that can be adjusted to take both 10″ and 12″ standard blades and hold them in any one of four positions 90 degrees apart. The latter feature lets you work in spots where frame clearance might otherwise be a problem.

Most frames are channeled, but you may want to consider the tubular ones now offered by several manufacturers. They are somewhat lighter, though equally strong. Either way, look for a firm handle bond and minimum play in the stretchers that hold the blade.

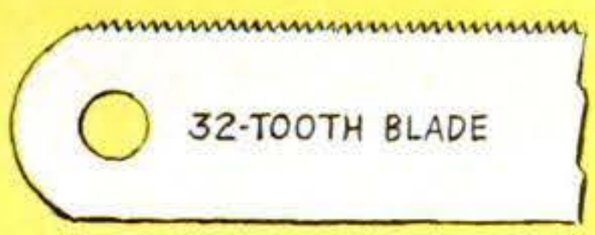
Choosing the right blades. Standard hacksaw blades come with 14, 18, 24, or 32 teeth to the inch. Use blades



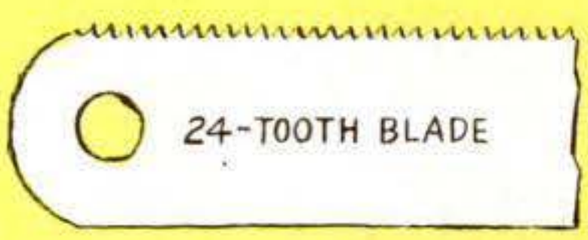
CHANNEL-FRAME HACKSAW



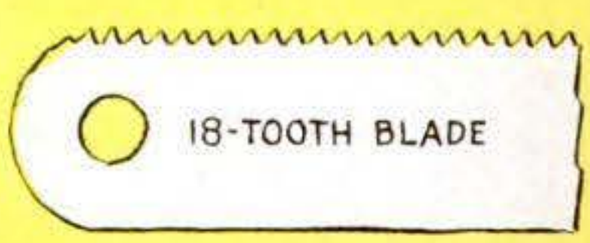
TUBULAR-FRAME HACKSAW



32-TOOTH BLADE



24-TOOTH BLADE



18-TOOTH BLADE

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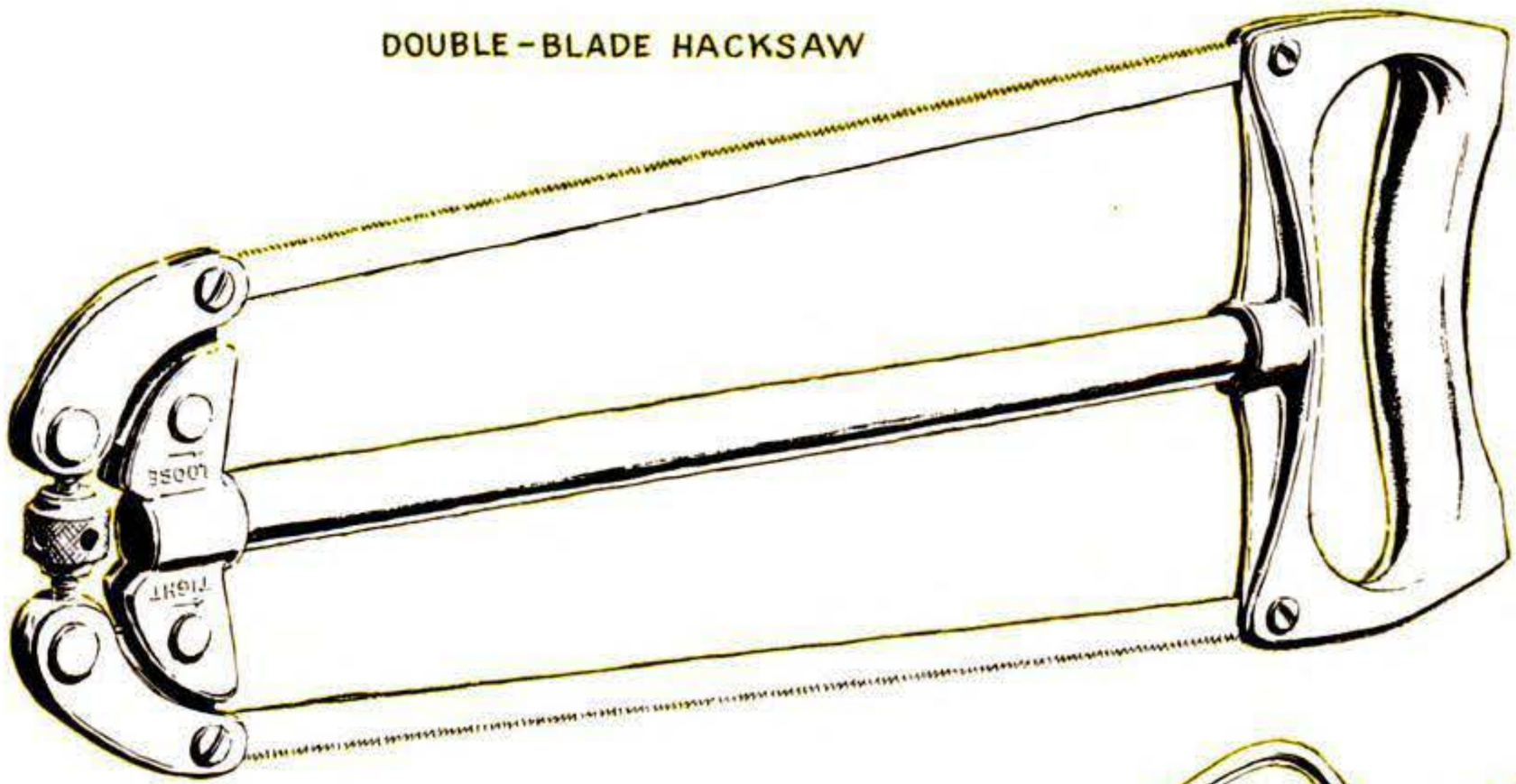
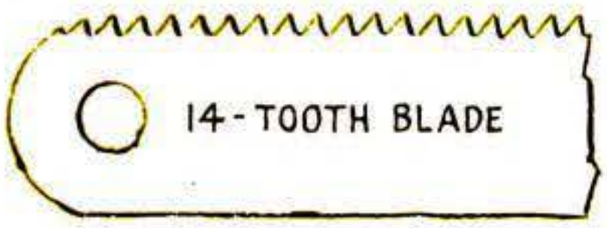
with 14 teeth to cut material 1″ or thicker in cast iron, machine steel, aluminum, brass, bronze, copper or slate. Eighteen teeth are right for ¼″ to 1″ high-speed steel, annealed tool steel, aluminum, bronze, copper or light structural shapes. You'll find 24 teeth best for ⅛″ to ¼″ sections of iron, steel, brass, copper tubing, wrought-iron pipe, conduit, drill rod, metal trim, heavy sheet steel, BX electrical cable and light structural shapes. Use 32 teeth for the things just listed when they are ⅛″ or thinner. It's also the right blade for cutting thin-walled conduit and most sheet metal.

How to use a hacksaw. To place a blade in a hacksaw, first adjust the length of the frame. Then slip the holes in the blade over the pins at front and back of the frame. Apply tension by turning the handle screw until the blade "pings" when you pluck it with your thumb. After a few cuts, tighten the screw further.

To start an accurate cut, use your thumb as a guide, sawing slowly with short strokes. As the cut deepens, use one hand to grip the front of the frame. Take full-length strokes, using both hands to equalize downward pressure on forward strokes. Lift the saw slightly on the return. Stand with feet 12″ or more apart. Flex your knees in line with the stroke to add a slight body sway to your arm motion. A good sawing speed is 40 to 60 strokes a minute.





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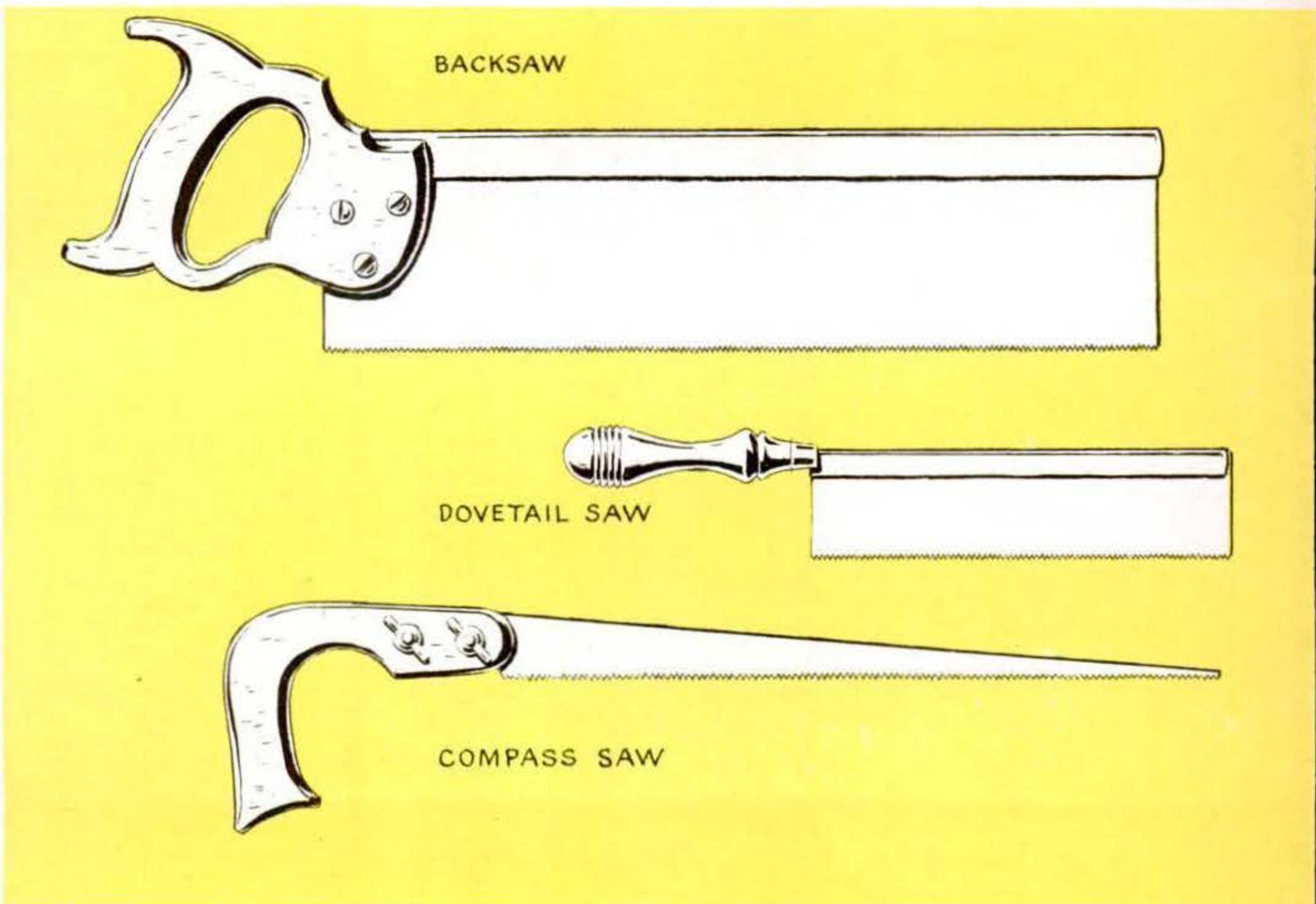
Special wood saws you

ONCE you own the two basic wood-cutting saws and a hacksaw, no one can say which of some very useful secondary saws should be next on your list. But if you do much cabinetwork, these are the ones you should consider:

Backsaw. Designed to make precise, straight cuts for wood joints, backsaws combine fine crosscut teeth with a steel-braced blade. They range from 4″ midgets used by patternmakers to 28″ miterbox saws that will cut through 5″ stock. One with a 16″-by-3⅝″ blade is probably your best bet. It can be used with equal convenience either for free sawing or with a miterbox.

If you buy a miterbox, consider one that has either an adjustable track or guides on which the saw back rides. This gives you accurate control over the depth of cuts. Should a miterbox have a hardwood bed, always protect it with a piece of ¼″-plywood scrap.

To make your own miterbox, all you need are three strips of hardwood, screwed together to form a channel and slotted for 45- and 90-degree cuts. Here's a tip: Let the forward upright project 1″ below the bottom of the bed member. This provides a lip which you can brace firmly against the bench



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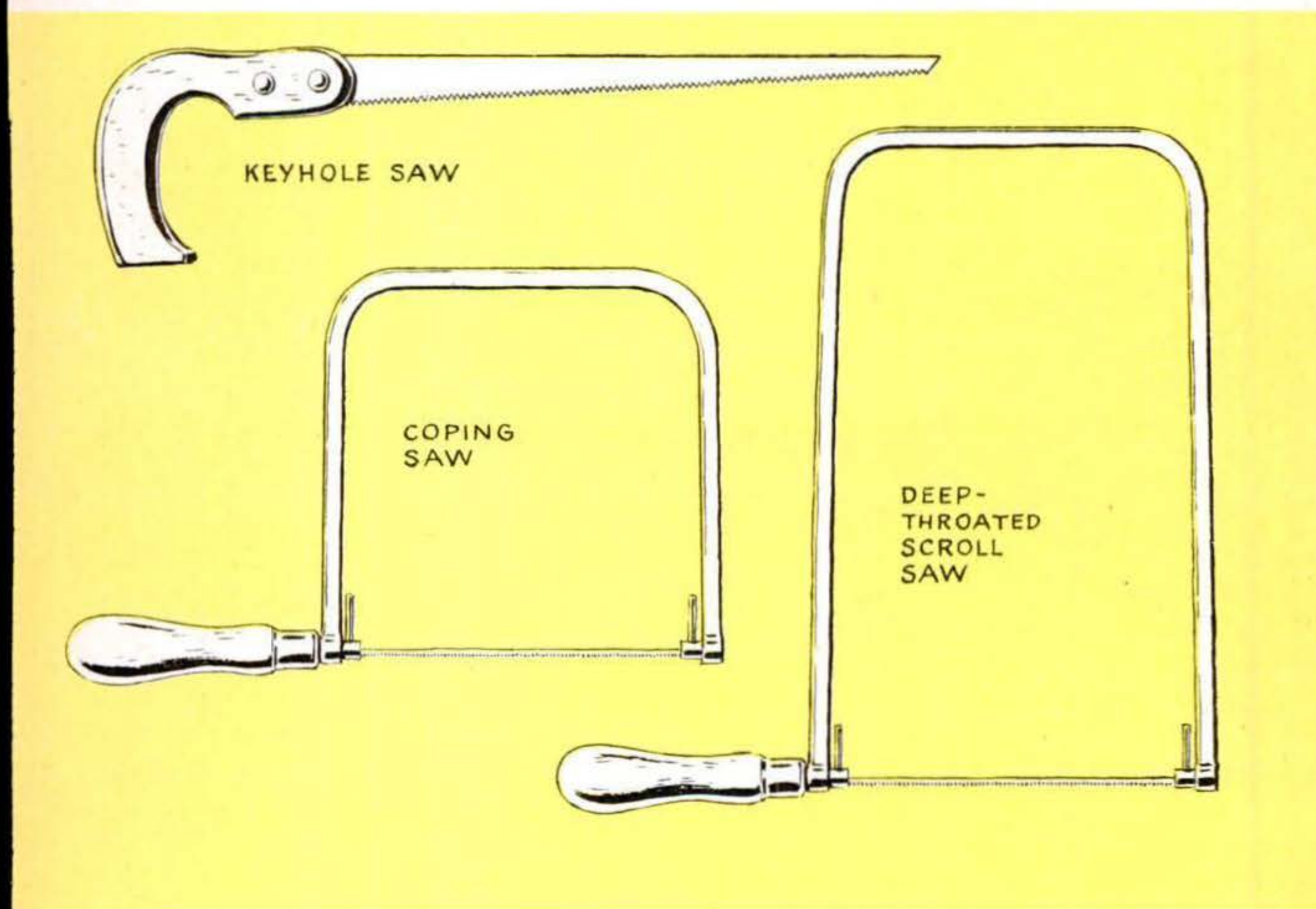
need most often

edge while you're sawing. This backsaw accessory will repay you many times over for the small amount of time it takes to put one together.

You may also find a dovetail saw useful. Shorter and somewhat shallower than a backsaw, it has a straight handle that offers a comfortable grip for undercutting.

Compass and keyhole saws. The reverse of a backsaw in its cutting characteristics, a compass saw takes broad or tight curves in heavy stock with a slim, tough blade that tapers to a point. There's no throat-clearance problem with this handsaw—it will work to the center of the largest panel. You can use it to run off an outside circle, the compound bows of a valance or, with a starting hole, to make any kind of an interior cut. It will also saw straight, if your wrist is steady. A poor-man's version of the now popular electric saber saw, it's still a very good buy at its modest price.

If, in using a compass saw, you have a bit of trouble getting around a tight bend without bowing the blade, try this: While pushing and pulling with your right hand, stiffen the blade by gripping its center with your left



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hand. Southpaws reverse the signals.

Still having trouble? Then try a smaller version of the common 12″ compass saw, a keyhole saw. It's rapier-thin blade lets it work where a compass saw won't. One particularly handy keyhole saw has a handle that can be slipped along the blade and clamped at any point. Moved well forward, it practically eliminates the chance of bowing.

Coping and scroll saws. The time may come when you'll want to cut fine fretwork for a piece of furniture—a speaker-enclosure grille, say. A coping saw or its larger companion, a scroll saw, are the tools for that. Very thin replaceable blades held in their U-shaped frames will follow the most intricate patterns, provided there's enough throat clearance. The blade ends are either looped or supplied with

6 lesser-known handsaws

Flooring saw. A wood saw with extra teeth on its back for starting its own hole anywhere. You worry this part of the blade through and continue with the regular teeth.

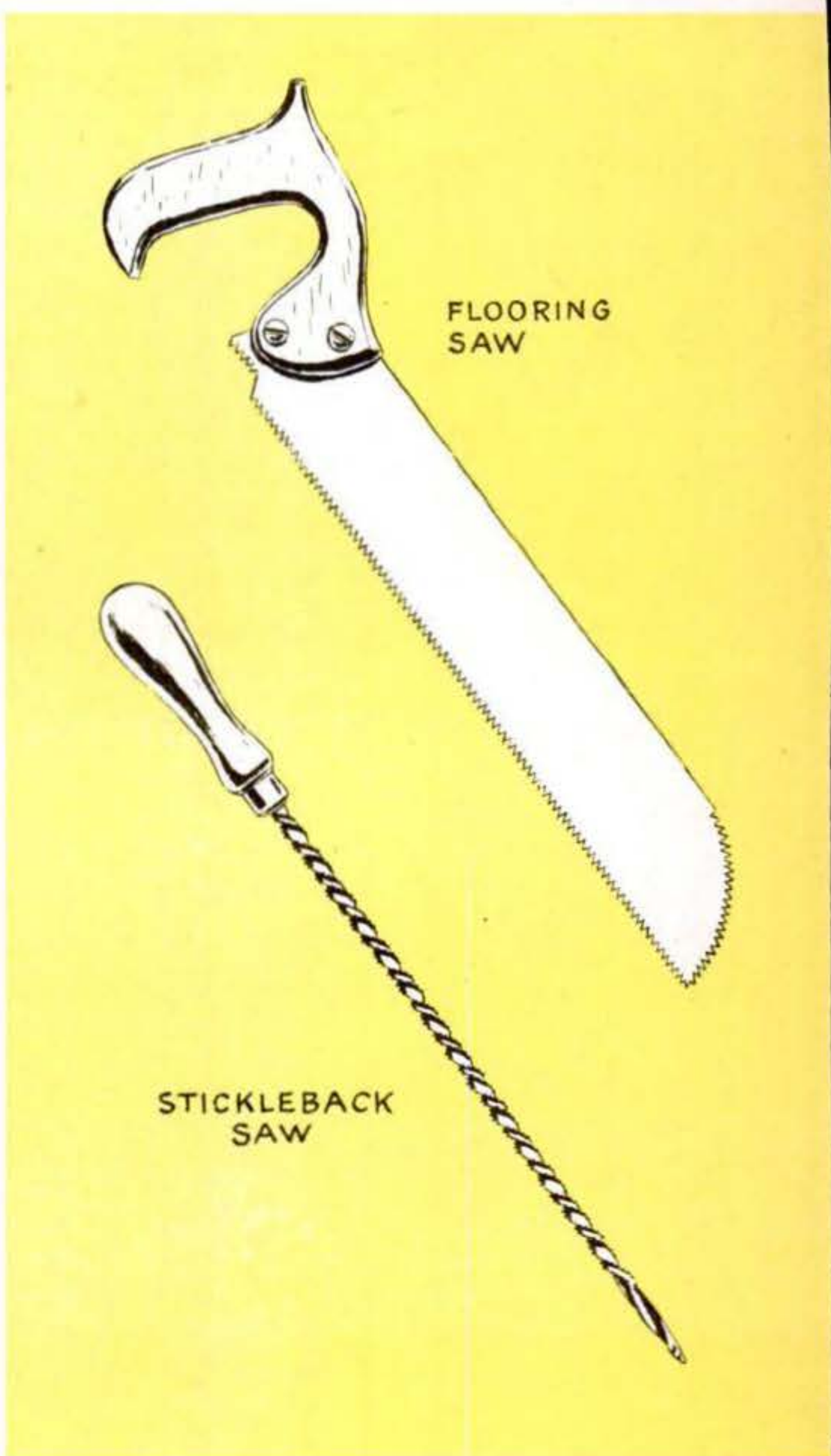
Stickleback saw. A handy tool for making holes in walls and panels. It has a fixed spiral blade with a drill tip. You twist it to make a starting hole, then cut with an in-and-out motion, sawing in any direction.

Metal-cutting handsaw. Fine hacksaw-like teeth let this versatile cutter bite through copper, brass and aluminum—as well as wood.

Plumber's saw. This 18-incher will cut lead and cast-iron pipe, along with joists or flooring containing nails. A reversible handle makes overhead sawing easy.

Nest of saws. A many-purpose tool with a coarse blade for wood; a medium blade for metals, plastics and fine wood; and a fine blade for sheet metal. These blades are also reversible for overhead work.

All-purpose saw (reversible blade). Handy for cutting off nails behind moldings; equally useful for sawing very hard counter-top materials.



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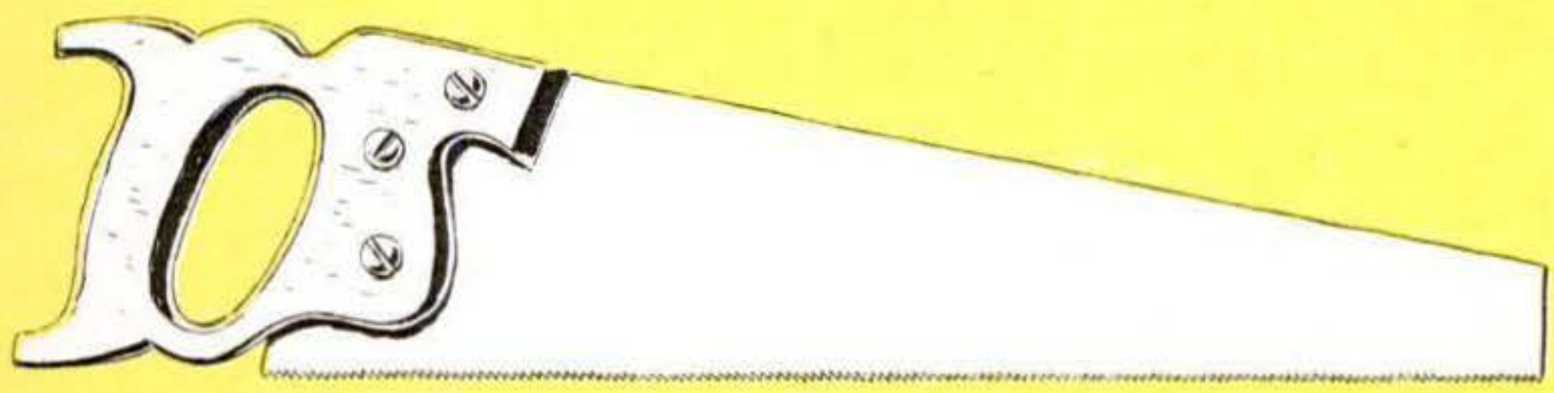
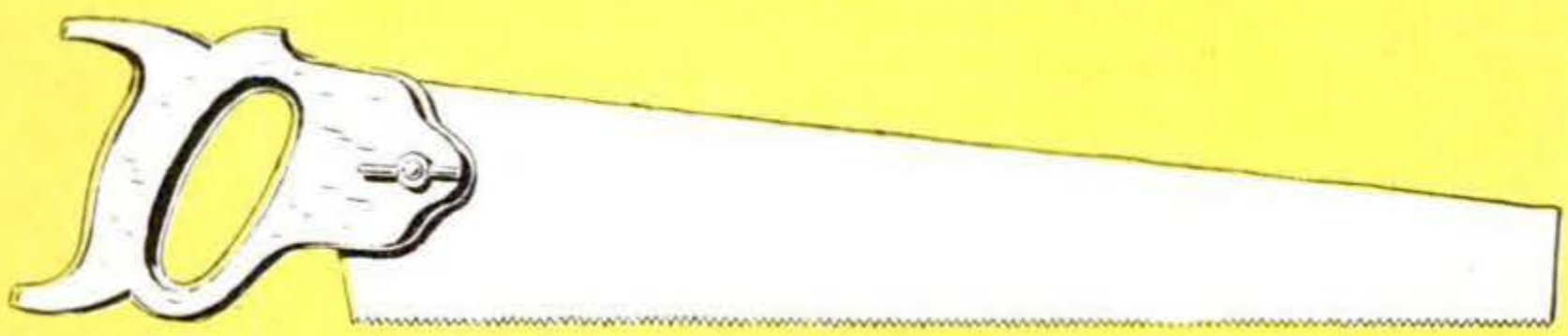
cross pins to fit notched stretchers at both ends of the frame. Twisting the threaded handle draws the blade taut. Good coping and scroll saws allow the blade to be gripped at any angle in the frame. To make an interior cut, you must drill a starting hole and slip the blade through it before attaching it to the frame. On inside cuts that call for square corners, saw down the full length of one straightaway, then back up enough to arc the blade to the next straightaway. Continue doing this until you have freed the bulk of the waste stock with a final curved cut. Then reverse the direction of the saw and clear out the quarter-round sections with short, straight cuts.

Some coping and scroll-saw blades eliminate the need to clear out corners. Either spiral or circular teeth let them cut in any direction.

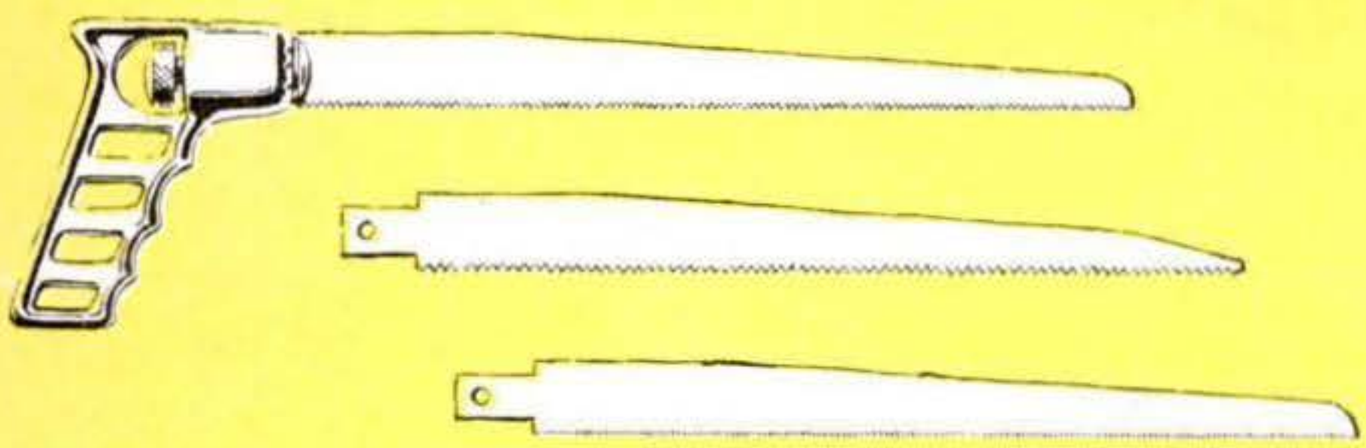


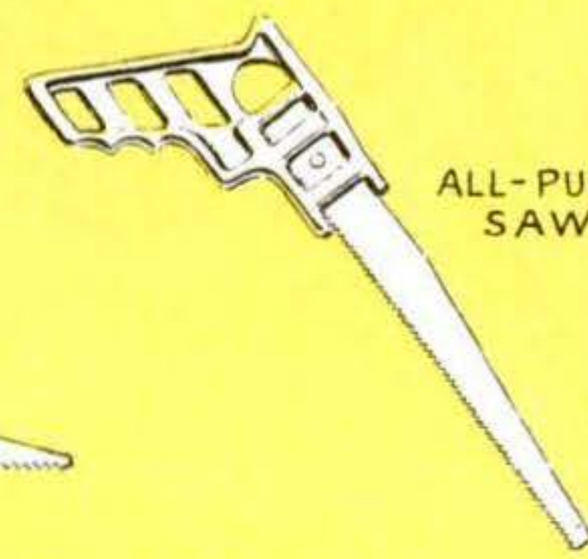
METAL-CUTTING HANDSAW



PLUMBER'S SAW

NEST OF SAWS





ALL-PURPOSE SAW

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P.S. EXTRA: YOUR TEAR-OUT BOOKLET NO. 12

To remove this booklet, place your left hand on the facing magazine page, grasp the booklet with your right, and pull it gently away.

After reading, file for future reference. You'll find it valuable on many home jobs.

December 1958
POPULAR SCIENCE

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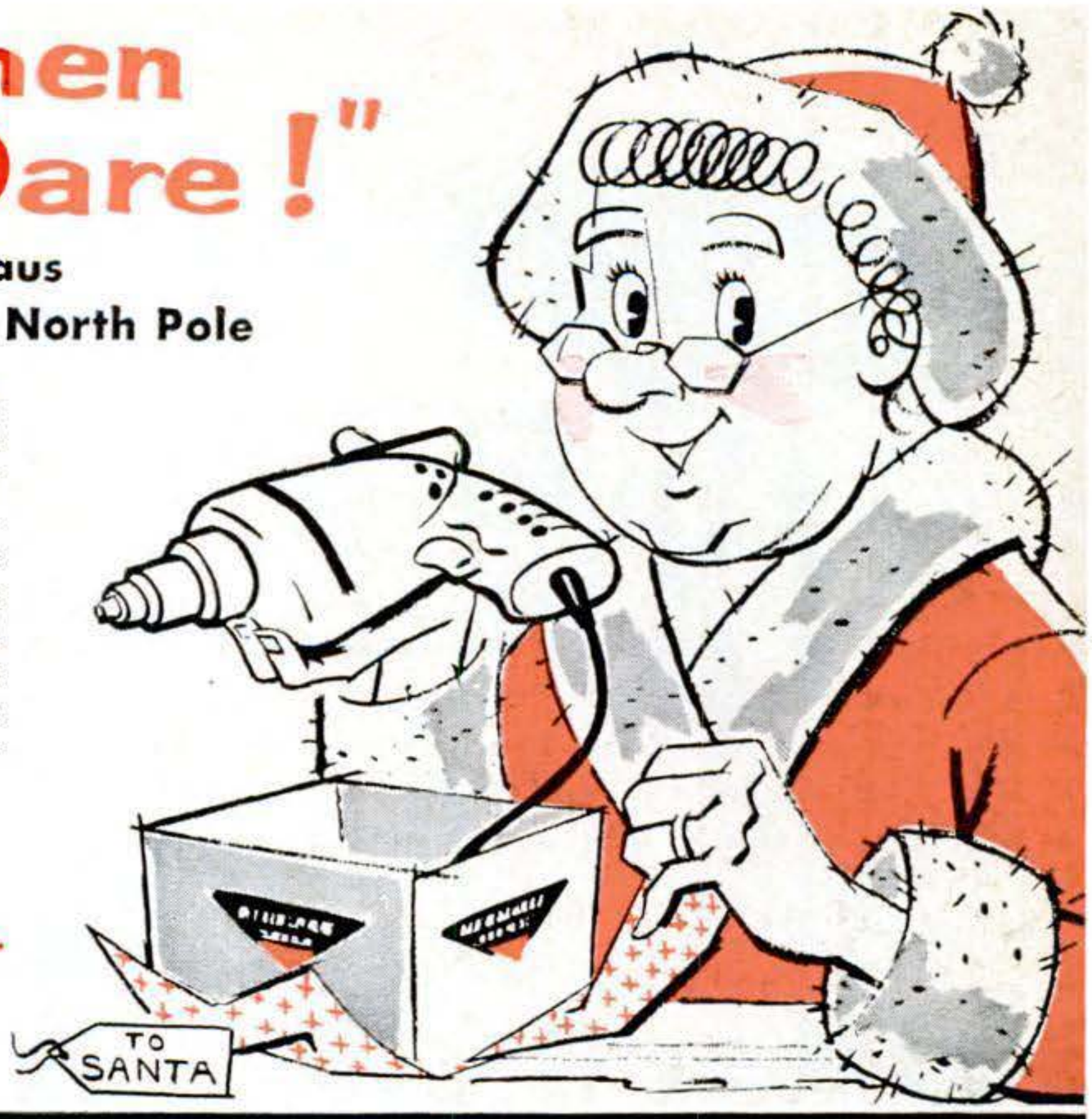
"Most Women Wouldn't Dare!"

Says Mrs. S. Claus
Giftway Drive, North Pole



Would your wife? Frankly, most women wouldn't dare pick out a tool for a Christmas present and feel sure it's the one that hubby really wants. Well, here's the perfect solution — for you, and for her. For you — it's the new 2.7 amp. 1114 Power Drill that drives a complete workshop with matched attachments. For her — it's a happy shoppers world if you get real "sneaky" and check the tools you want in this ad and leave it on her kitchen counter.

Christmas hints by

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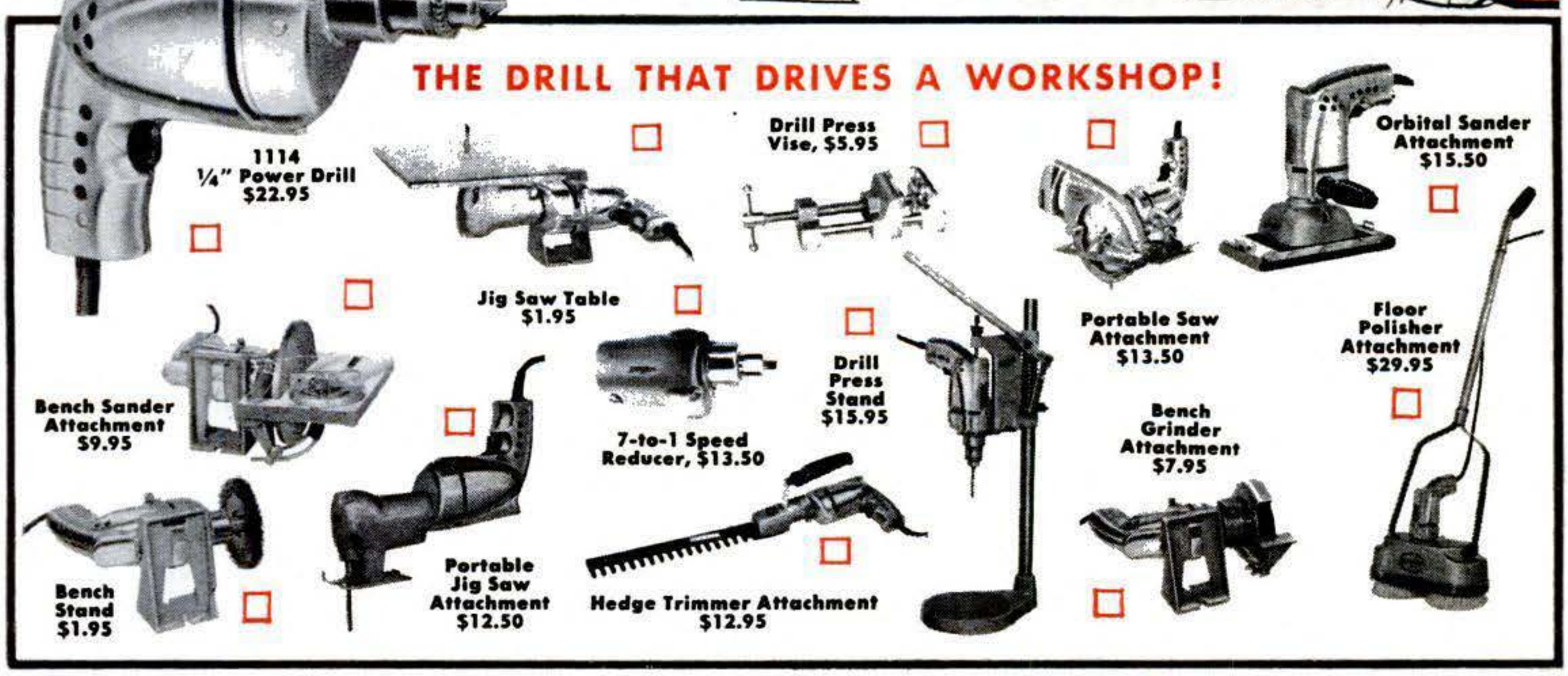
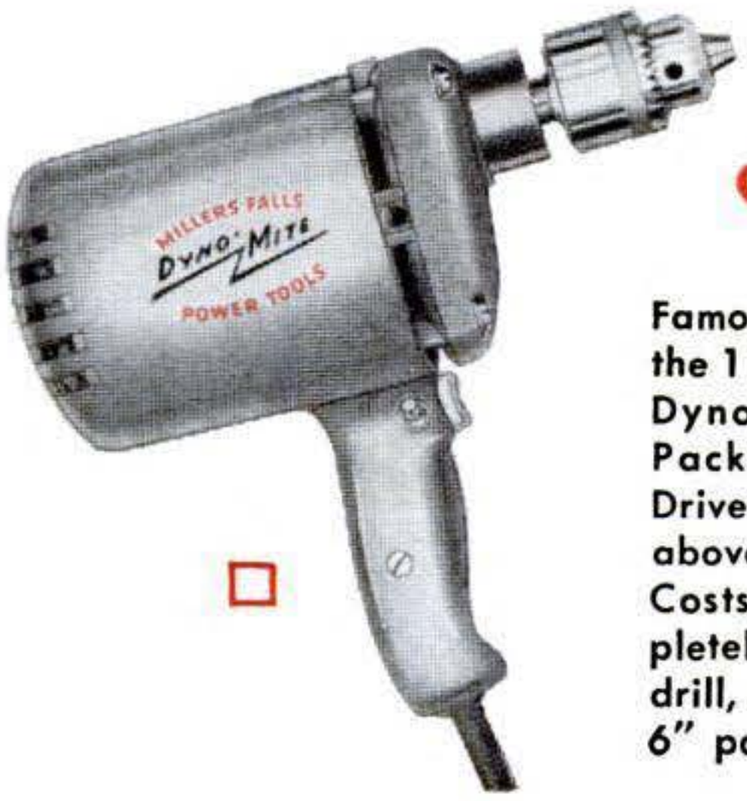
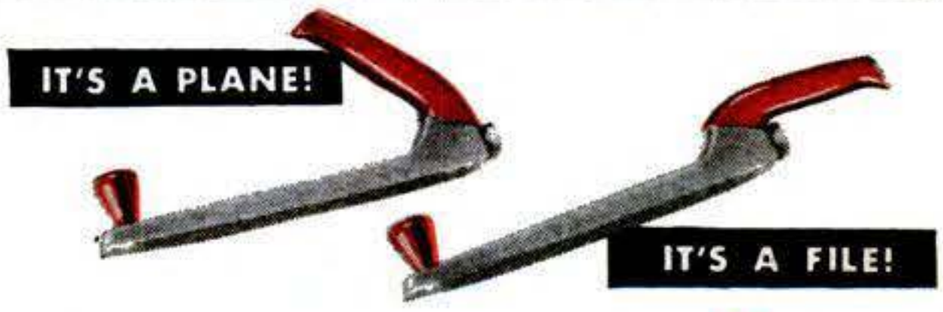




VERY *Special* GIFT

Famous "big brother" of the 1114 Drill—the "888" Dyno-Mite Power Unit. Packs a full 1/3 H.P. Drives attachments shown above and more besides. Costs only $39.95 completely equipped as ⅜" drill, 6" disc sander, and 6" polisher.



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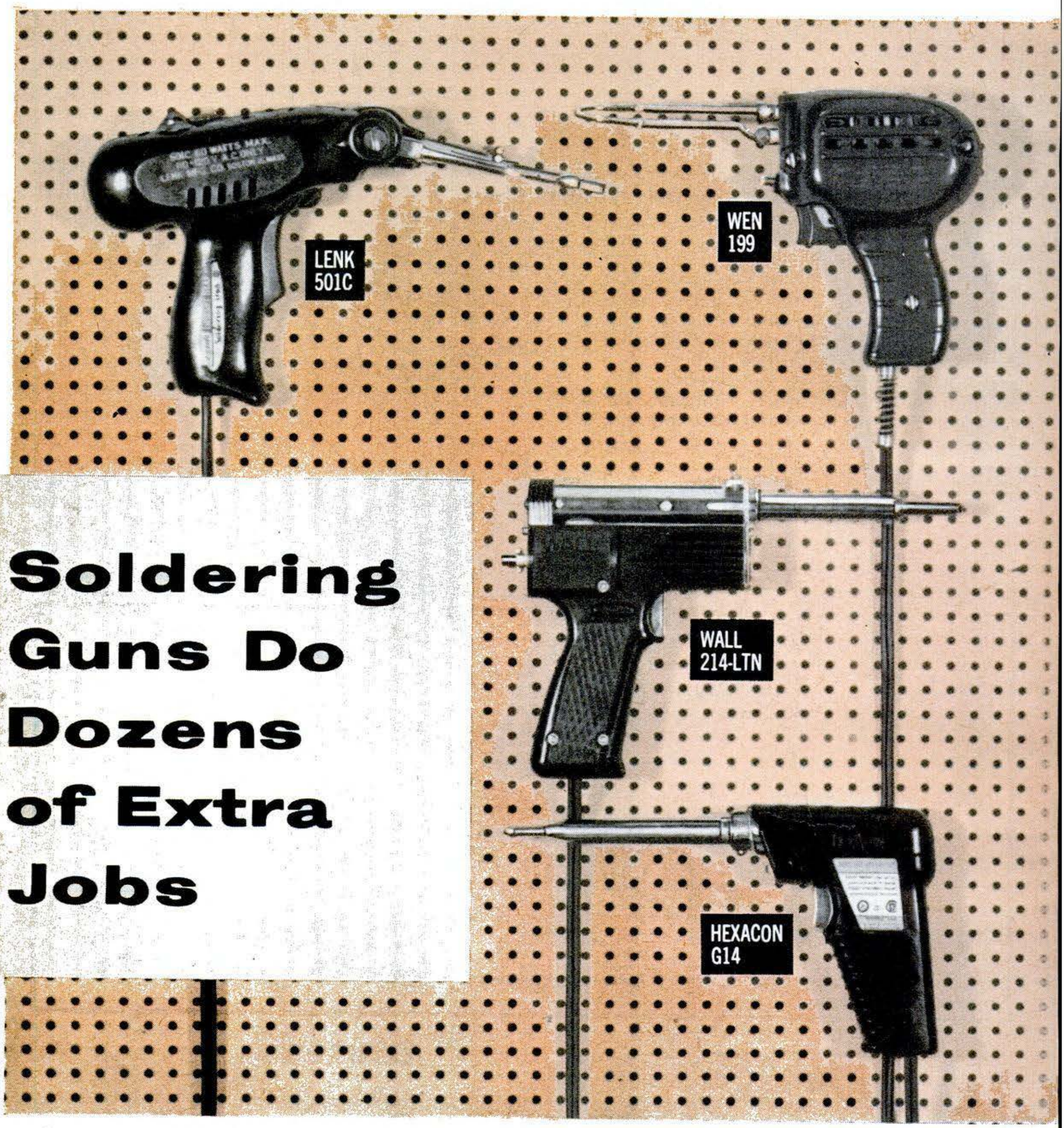

Soldering Guns Do Dozens of Extra Jobs

Use it just for soldering? Not at all. You can put the heat on dozens of household chores and repairs

By Jerry Parker

NEXT time you're in a do-it-yourself dilemma, pardner, you might reach for an electric gun. A soldering gun, that is. This versatile tool packs a red-hot punch that can put the whammy on many a workshop or household fix-it chore.

The electric gun is a streamlined, up-to-date version of the old soldering iron. Maybe you've used one for building hi-fi equipment, for metalwork, for electrical jobs. Undoubtedly you've liked its easy

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PISTOL-GRIP SOLDERING TOOLS are increasingly popular. Those that heat instantly are usually called guns. Some, like the pistol-grip Ungar above, are continuous-heat irons.

handling and its quick-trigger action. But did you know that it also will perform a host of cutting, welding, mending, sealing and burning jobs? In fact, it has almost come to the pass where the greatest contribution of the electric gun is made in *non*-soldering assignments.

Types of guns. There are two types of electric guns. One has a built-in transformer, the other a resistance-wire winding controlled by a thermostat. The transformer gun is heavier, bulkier, more powerful, works only on AC current. The resistance gun functions on AC or DC. Both guns operate the same way. They remain cool until you pull the trigger (or press the button). Then you get instant heat at the tip. You can get a gun of about 100 watts for $6. More powerful guns, up to 275 watts, cost $10-12.

In addition to its obvious virtues—the

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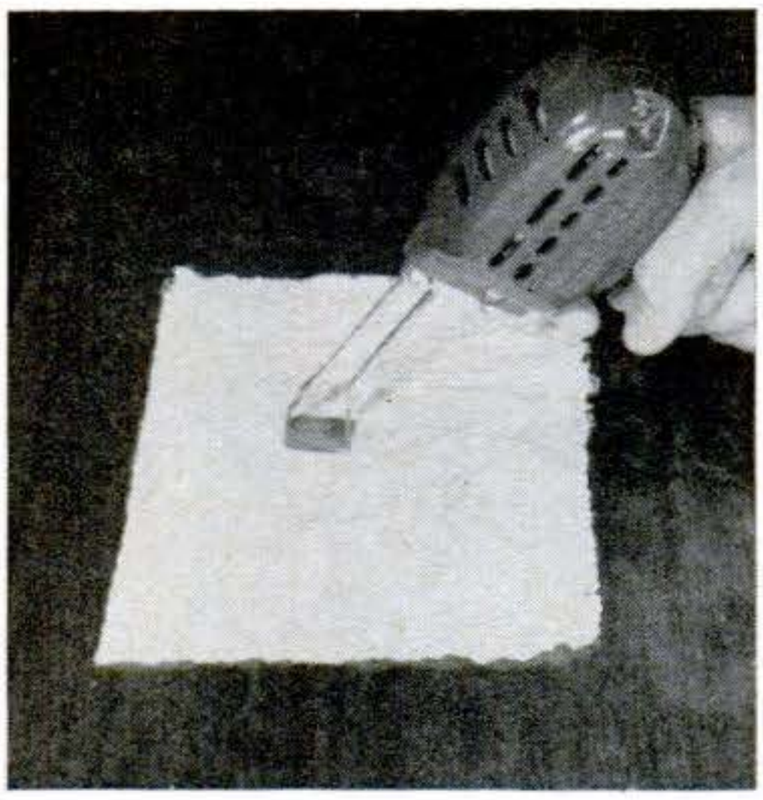
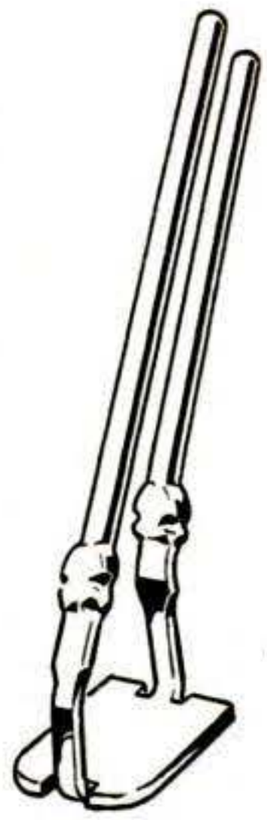
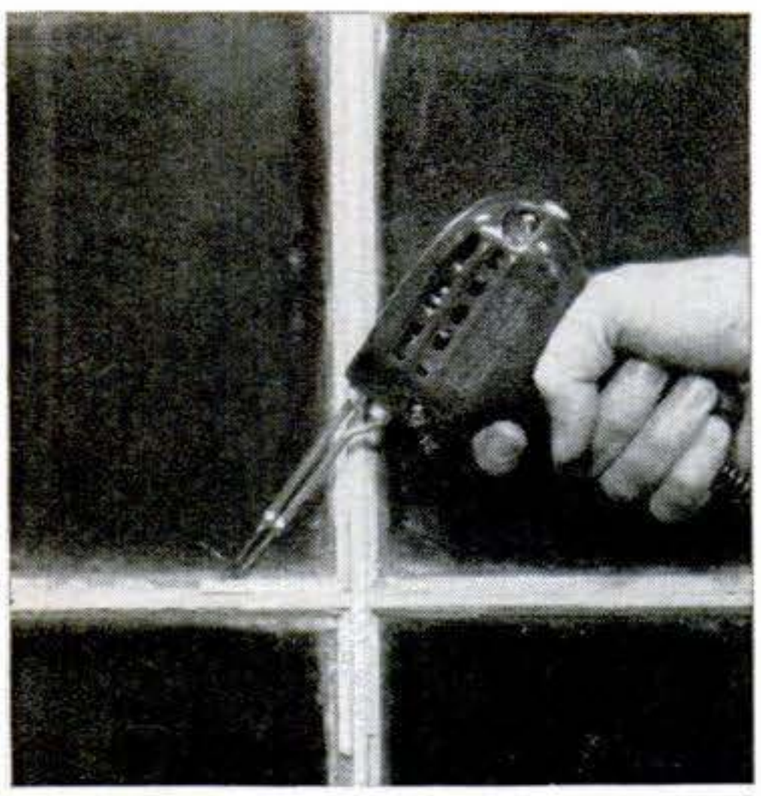




TAKING DENTS OUT OF WOOD is easy with a smoothing tip in the gun. Run the hot tip over a dampened cloth; the steam generated will cause wood fibers to swell, erasing the dent.



REMOVING OLD PUTTY from window frames, an otherwise irksome job, is a cinch with a cutting tip on the gun. When red-hot, the tip slices through even bone-hard putty like cheese.

easy pistol grip, the way the barrel gets into almost inaccessible places—you have interchangeable tips of unusual design for your electric gun. These extra tips (they cost around 60 cents each) are what make it a jack-of-all-trades.

Besides a soldering tip, you can fit your gun with a sharp cutting tip or a broad smoothing tip. With these, you can perform an amazing variety of work.

Cutting. You slip the cutting tip in your gun, tighten the setscrews, press the trigger, and in seconds the tip glows cherry red. What can you cut? Almost anything but metal.

One of the handiest uses of the tip is in cutting plastic wall tile or resilient floor tile. The way to do it: Turn the tile over, mark your cut, draw the hot tip along the line. Smooth the underside of the cut if necessary.

The cutting tip is also fine for removing old putty. This can be a nasty, even hazardous, chore when you go at it with a chisel. Your electric gun will burn out the ossified putty as though it were cream cheese.

The cutting tip makes a good burning tool, too. You can use it to burn your name or initials in the handles of your tools. You can make rustic but good-looking house signs and markers. Or you can manufacture long-lasting identification tags for garden plants and bushes.

Plastic welding. Your electric gun is the best first aid for any broken or torn plastic gadget around the house. Join the broken parts and hold them, with a small clamp if necessary, while you make a pass or two over the joint with the smoothing tip of your gun. Lightly smooth the finished joint. You'll find that plastic sets in seconds.

Sometimes softening one part and pressing the other against it will do the trick. On sheet-plastic material you may need to put a piece of paper under the tip of your gun to keep it from sticking.

Heat sealing. The smoothing tip will also seal freezer packages or other wax or plastic bags and wrappers. It's essential to keep a plain piece of paper between the gun tip and your work so that the material being sealed won't stick to the smoothing tip. A light application of heat will do the job.

Camera fans will find a gun invaluable for mounting color slides. Use the smoothing tip to seal the edges of the cardboard holders.

Furniture repair. This is one of the many odd jobs for which the electric gun is uniquely fitted. You can use it to eliminate dents, for instance. Put a damp cloth over the dent. Place the hot smoothing tip of your gun over cloth and dent, and keep it there until the cloth is dry. The tip will generate steam, causing the wood fibers to swell. Presto!—the dent has disappeared. If it's a real deep gouge, you may have to repeat the operation.

To conceal scratches or nicks, use the smoothing tip to melt stick wax or stick shellac. Daub the wax or shellac on the scratch and smooth out.

Other uses. This category is as unlimited as your imagination. For one thing,

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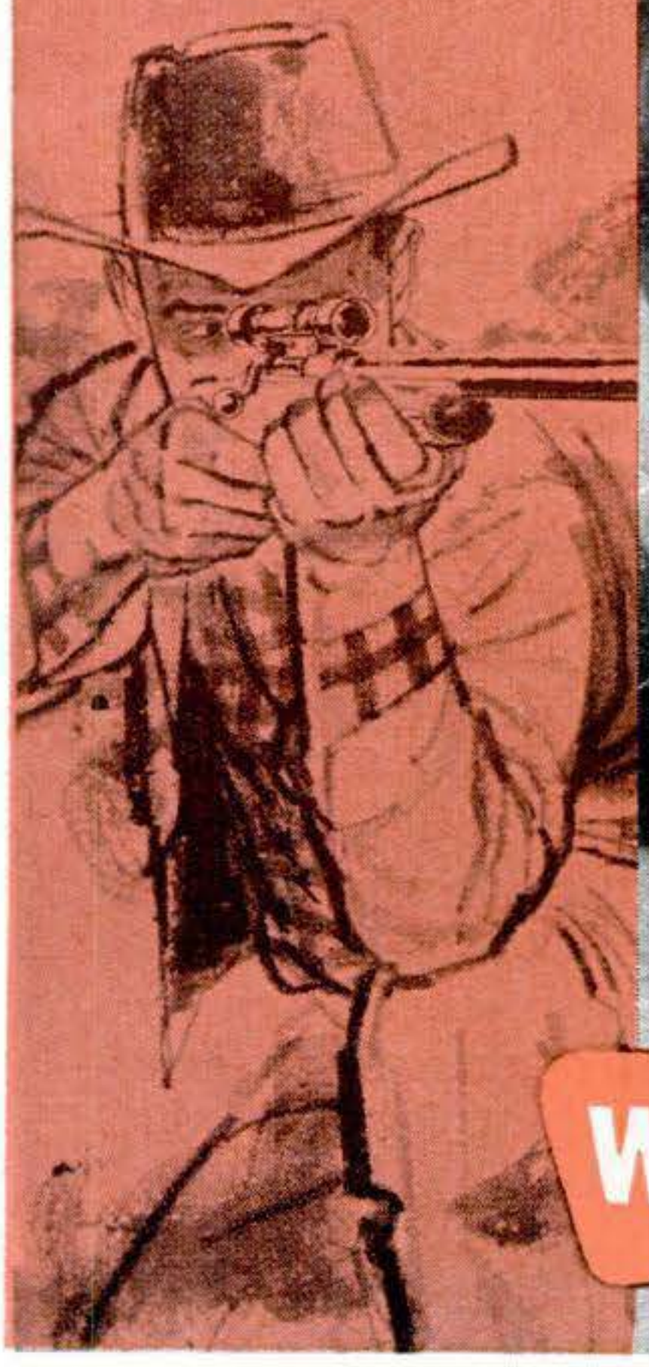
There is nothing like the feel of the right gun . . .



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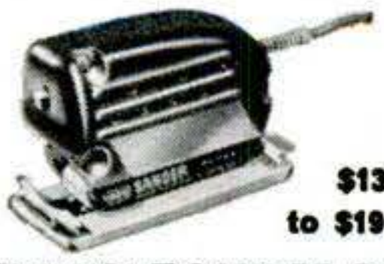

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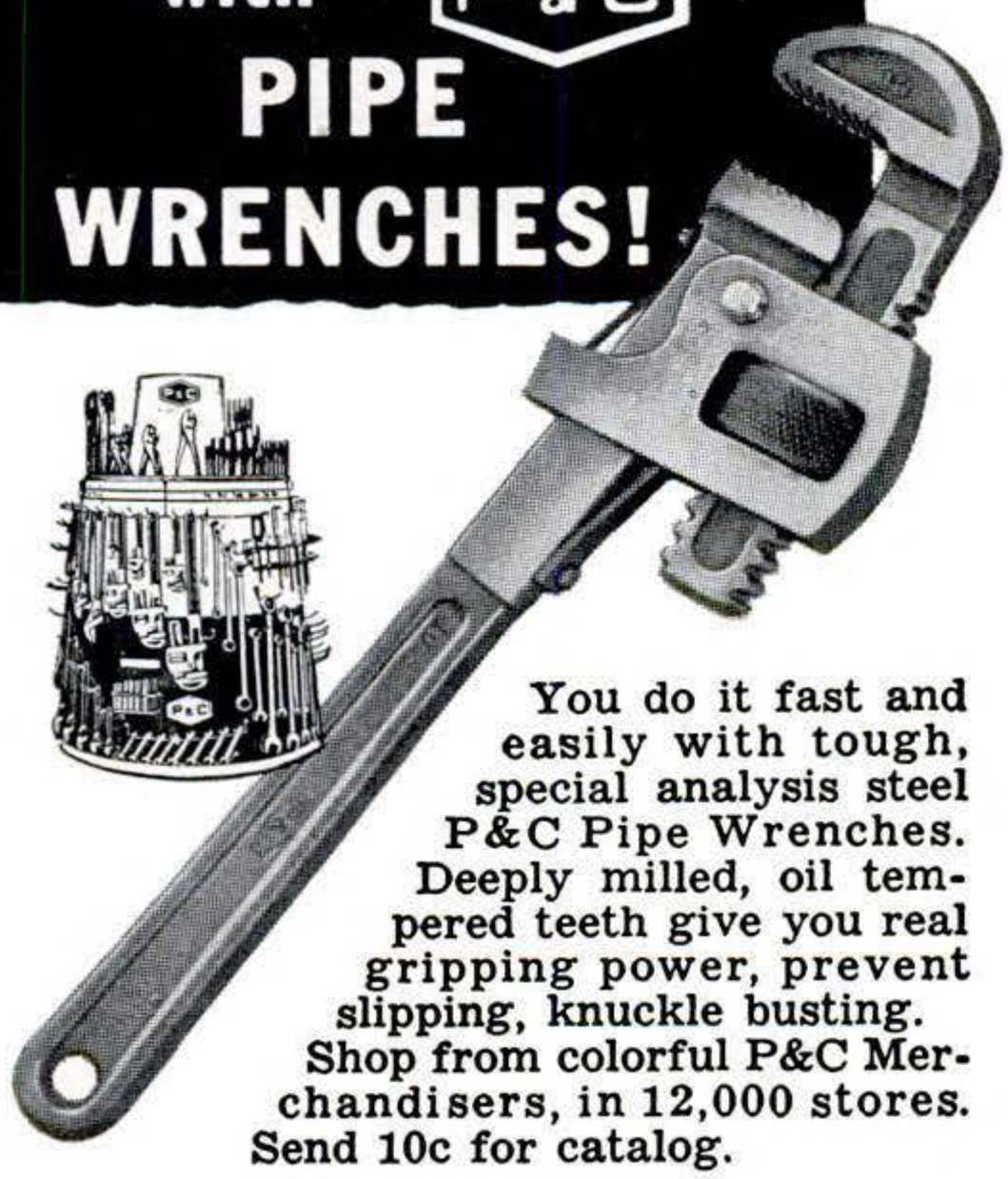

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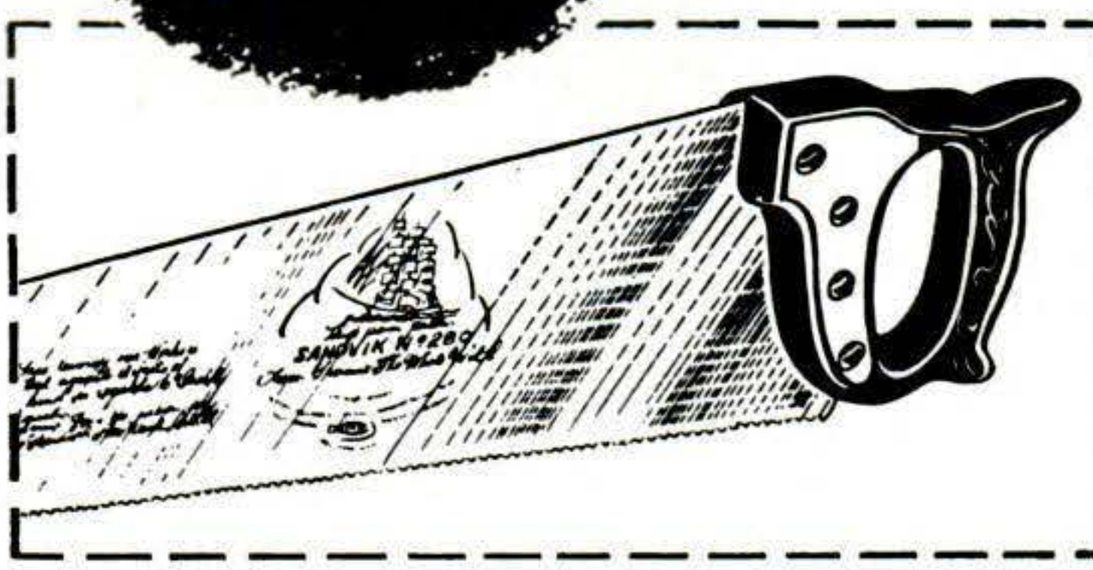

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your electric gun will do a dandy job of applying the thin wood tapes used to cover plywood edges. These tapes usually have a thermosetting adhesive on the back. After you have wet the adhesive with the recommended solvent, put the tape in place and use the smoothing tip of your iron to weld it there.

Homemade Tips Increase a Gun's Usefulness

By Joseph Tartas

OBSTINATE soldering jobs that resist your best efforts to get a clean, tight joint with a conventional gun and tip are a breeze with a special tip you can make yourself for only a few pennies. The soldering gun will reach tighter spots and handle heavier jobs.

Chassis ground connections, heavy solder lugs, bus wires and similar electrical jobs that try your patience can be done in seconds. Tempered metals such as spring brass, beryllium-copper and phosphor bronze can be soldered to heavier metal parts without drawing the temper.

How it works. The special tip is nothing more than a pair of electrodes inserted in the soldering gun. These let you shoot low-voltage, high-amperage current *through* the metal to be soldered. The heavy current flowing through the workpiece heats it just as wire in an electric heater is heated by current flowing through it.

All the heat is concentrated right where you want it—in the area of the metal to be soldered that's between the electrodes. The work itself actually becomes part of the soldering-gun circuit. A soldering iron, by contrast, must transfer heat to the work by conduction.

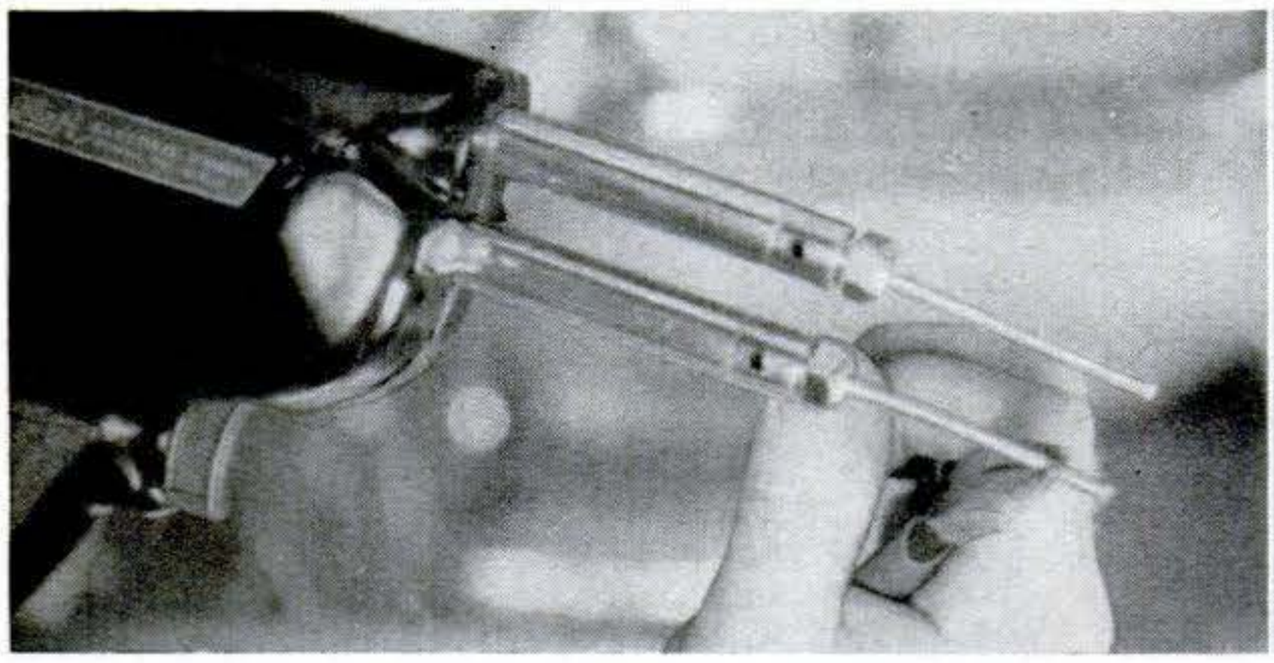
Use a heavy-duty soldering gun rated at 275 watts for best results. A 250-watt gun will work too, though slower. Light-duty guns lack the heating capacity to handle large pieces of work.

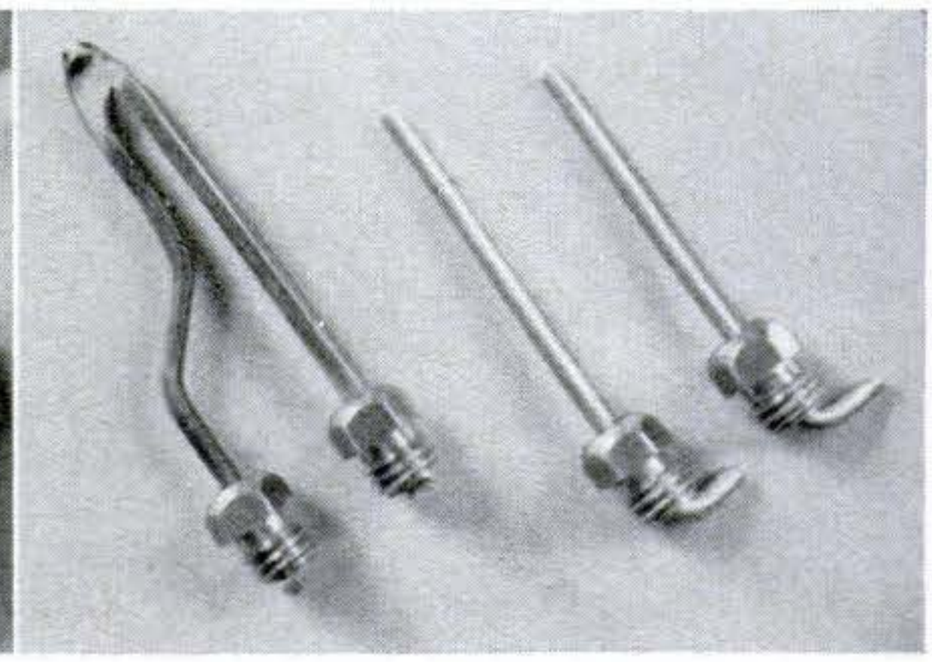
To make a tip, you need an extra pair of tip nuts and less than a foot of #8 copper wire. Cut two 4″ lengths of wire and bend an end of each to fit into the gun. With wires inserted and resting on a work bench, file flats on their exposed ends. This should be done with the gun handle pointing to the left if you're right-handed.

Tinning the tip. Rest the tip on a piece of metal and lay a strip of flux-core solder across the wires. Press the trigger. When the solder melts, wipe it onto the tip with a rag or stiff brush.

Now the special tip is ready for use. Simply bend the ends of the wires before each job so they will straddle the work with the shortest possible path.

To solder well, hold the tips firmly against the work. A good electrical contact is necessary to get maximum current flow and heat. Tighten the tip nuts occasionally to ensure close contact—corrosion can weaken a connection. Sometimes an entire tip becomes so corroded it must be replaced. Overlong heating times that are not improved by tightening the tip nuts are a sign of this.





BEND THE HOMEMADE TIPS to fit each job. Tip ends should just straddle the work to be soldered —to keep the heating path as short as possible. This keeps heat from being wasted. Regular and homemade tips for one 250-watt soldering gun are shown above. The homemade tips (pair at right) were bent with pliers from #8 wire as described in the text above. END

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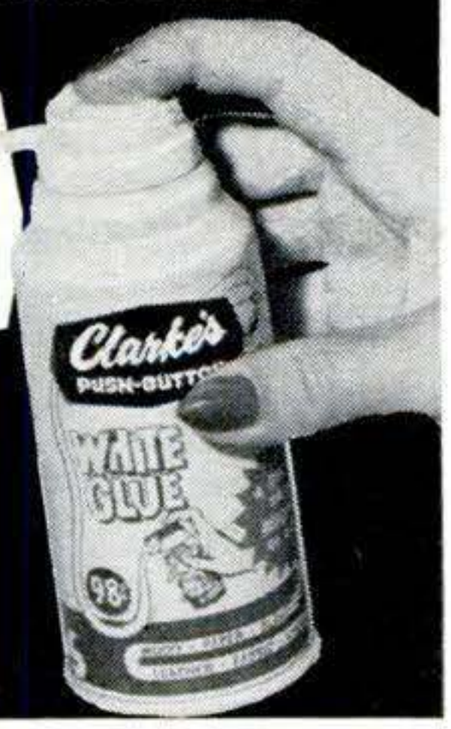

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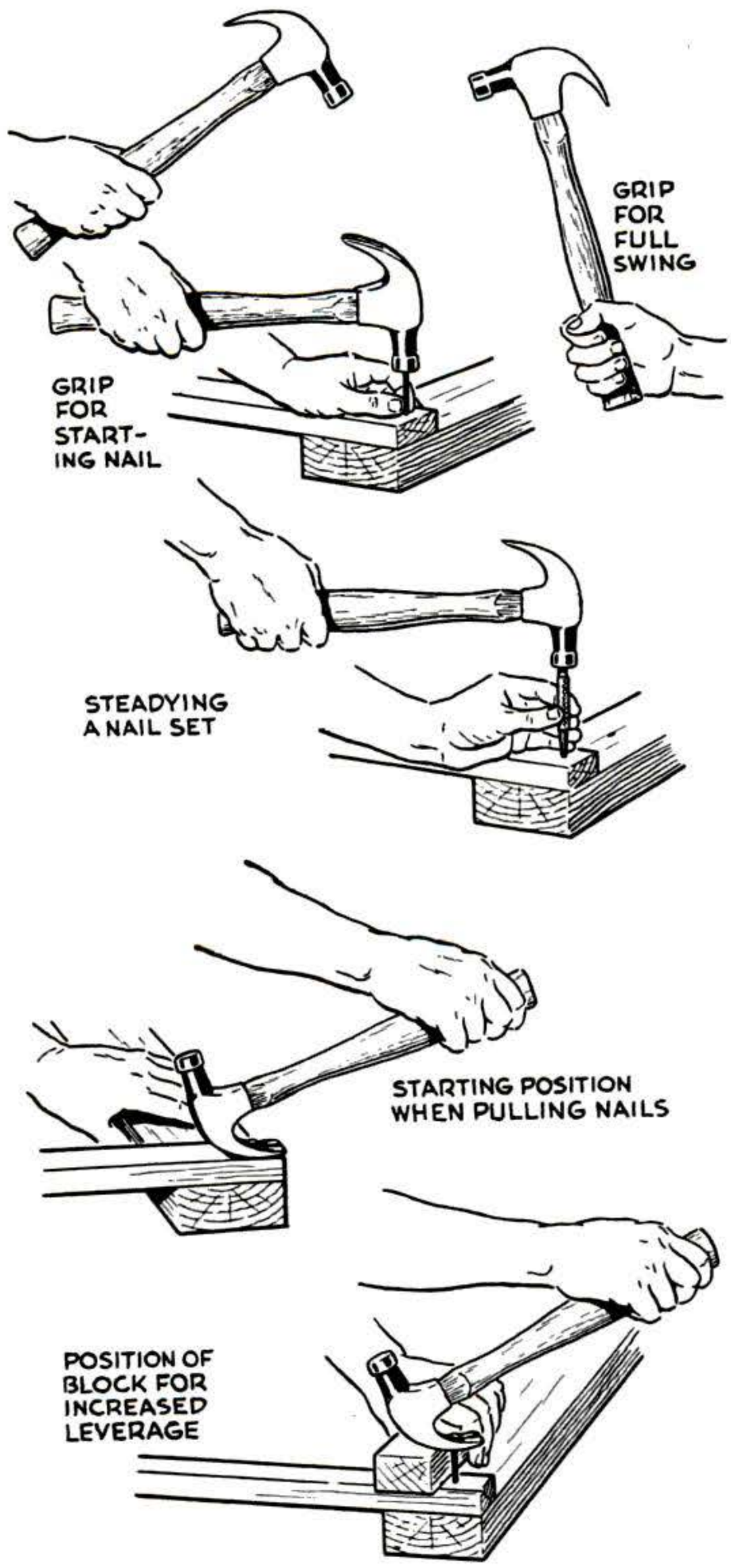
Using a Nail Hammer



The right grip. To start a nail, or when working in very cramped quarters, you'll find it easiest to choke the hammer handle (grip it a bit forward toward the head). Hold the nail between your thumb and forefinger, with the point pressed against the work at the desired angle. Give it a couple of light taps. Then get your fingers out of the way. Now grip the handle about an inch from its end, heft it, and shift your hand if necessary, until the tool feels nicely balanced. Rest the face of its head squarely on the nail and give it another tap to determine your aim.

The right swing. Hammer blows are delivered through the wrist, elbow and shoulder, or all three, depending on the force you want to exert. Swing rhythmically, in an easy arc. Don't let the hammer head twist, and keep the handle parallel to the nail head at the moment of impact. This way, the face will always deliver square blows. If a nail bends, draw it and start a new one in a new place.

When you use a hammer with a nail set to drive finishing nails below the surface of wood, strike the head of the set just as squarely as you would a nail. At the same time, rest your little finger on the work in a position that steadies the set and prevents its slipping off the nail head. Sink heads about 1/16″ below the surface.

Nail pulling. Use the claw to lift the nail head about ½″. Then put a block of wood under the hammer head to provide a fulcrum for extra leverage and prevent damaging the wood and bending the nail.

7 Hammer Do's and Don'ts

- *Do* keep hammer heads clean and dry. A greasy face may slip off a nail and damage the work, or your hand.
- *Don't* hammer with the side, or "cheek" of the head. It won't take such abuse.
- *Do* strike with the *center* of the face. It's specially hardened for that purpose.
- *Don't* damage the face by striking steel harder than itself. Use caution when working with case-hardened nails.
- *Do* grip a hammer firmly. Otherwise it may fly out of your hand.
- *Don't* use a hammer with a loose head, or tape up a handle that's even slightly fractured. Apply new wedges to retighten a loose head—a new handle if the old one is cracked.
- *Don't* use a hammer claw to pry heavy framing members apart, strip off clapboards, or open big crates. A wrecking bar is the right tool for these jobs.

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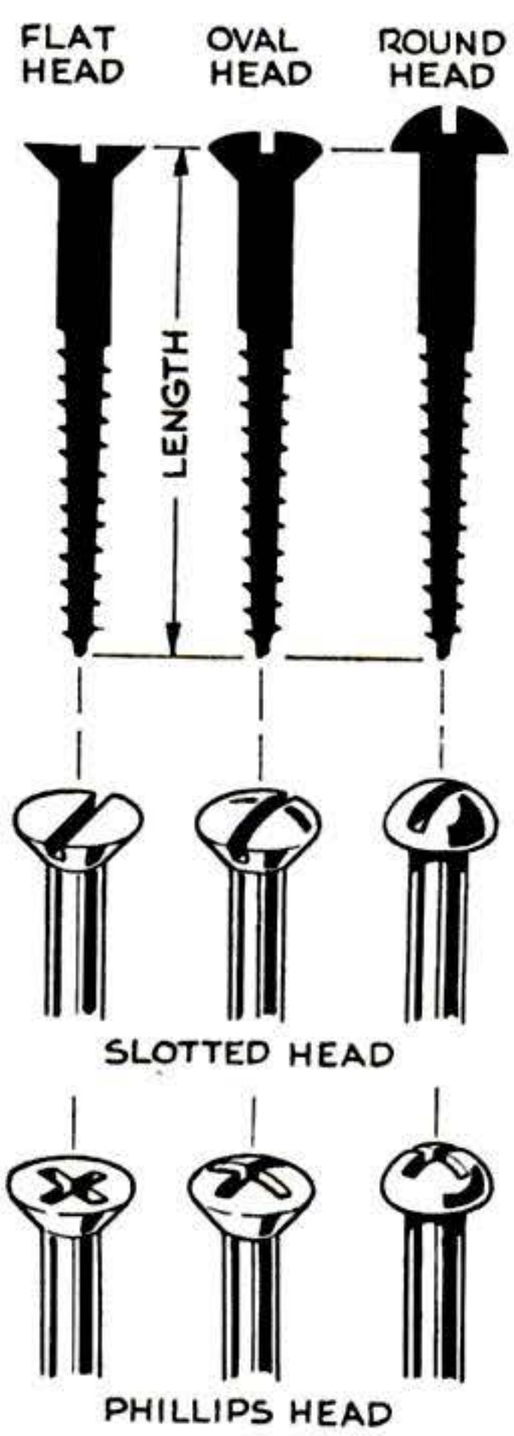
Wood Screws (types and sizes)

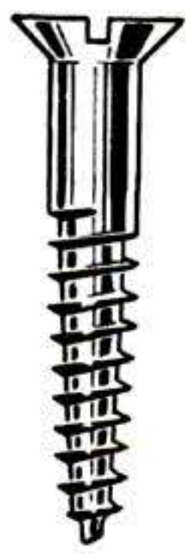
materials file

TO FIT the screw to the job, select a size at least 1/8" shorter than the combined measurements of the two pieces being joined. Where strength is important, use the largest diameter of screw that's made in the length you require.



THE length of a screw is measured from the point to the largest diameter of the head, whatever the type—to the flat surface of flatheads, the ridge of ovalheads, the underside of roundheads.

WHERE heads will be exposed, consider Phillips heads. The Phillips head centers the driving bit automatically, is ideal for power screwdrivers. Phillips are available in all head styles, although not as widely stocked as slotted.



WHEN buying screws, ask for length, number and type —in that order. The screw shown is, perhaps, the most popular size. It's commonly used for joining 3/4" pine or plywood. It is a 1 1/4"-12, flathead, and that's what *you* ask for.

SCREWS are made of steel, brass, silicon bronze, aluminum and stainless steel, with various plated finishes. Plain steel screws are fine under filler or plugs. Use plated screws for matching hardware and for mild corrosion-resistance. Where heavy corrosion is likely, choose galvanized steel, brass, chrome-plated brass, bronze, aluminum or stainless.

Screw No.	Shank Diam.	Lengths Available	Actual Shank Size
0	.060"	1/4"-3/8"	
1	.073"	1/4"-1/2"	
2	.086"	1/4"-3/4"	
3	.099"	1/4"-1"	
4	.112"	1/4"-1 1/2"	
5	.125"	3/8"-1 1/2"	
6	.138"	3/8"-2 1/2"	
7	.151"	3/8"-2 1/2"	
8	.164"	3/8"-3"	
9	.177"	1/2"-3"	
10	.190"	1/2"-3 1/2"	
11	.203"	5/8"-3 1/2"	
12	.216"	5/8"-4"	
14	.242"	3/4"-5"	
16	.268"	1"-5"	
18	.294"	1 1/4"-5"	
20	.320"	1 1/2"-5"	
24	.372"	3"-5"	

TO FIND THE SIZE of a screw, place it between the parallel lines beside the screw numbers above until you find a pair of lines exactly equal to the screw diameter. Lengths listed on the chart increase by 1/8" up to 1"; by 1/4" from 1" to 3", and by 1/2" from 3" to 5".

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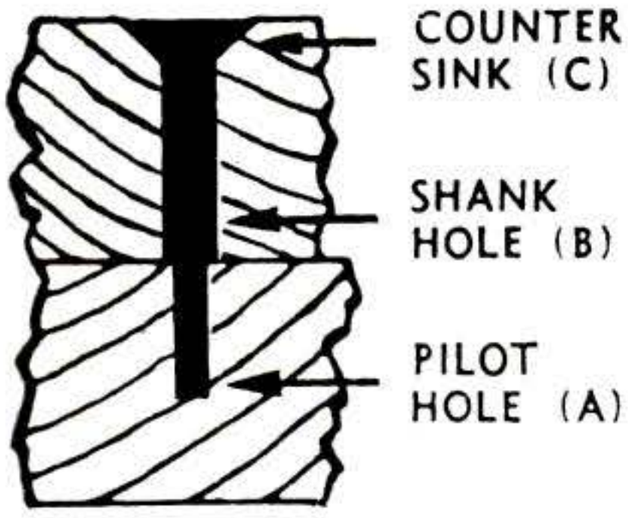
REFERENCE CHART

HOLE SIZE RECOMMENDATIONS* FOR

WOOD SCREWS



One of the ways in which home craftsmen produce projects with a professional look is in the attention paid to small but important construction details. One of these "quality" details is use of the proper size pilot hole. Especially when working with hardwoods, screws are easier to drive and there is less chance of damage if pilot and shank holes are drilled as per the illustration at left. The holes should be slightly smaller than thread diameter of screw, and bored to a depth of half the length of screw thread penetration into the second piece of wood. Length of screw should be at least 1/8" less than combined depth of material being joined. See chart below for standard specifications.

No. of Screw	PILOT HOLES (A)				SHANK CLEARANCE HOLES (B)		COUNTER-SINK (C)
	HARD WOODS		SOFT WOODS				
	TWIST BIT (Nearest size in fractions of an inch)	DRILL Gauge No. To be used for maximum holding power	TWIST BIT (Nearest size in fractions of an inch)	DRILL Gauge No. To be used for maximum holding power	TWIST BIT (Nearest size in fractions of an inch)	DRILL Gauge No. or Letter To be used for maximum holding power	NO. OF AUGER BIT To Counterbore for sinking head (by 16ths)
0	1/32	66	1/64	75	1/16	52	—
1	—	57	1/32	71	5/64	47	—
2	—	54	1/32	65	3/32	42	3
3	1/16	53	3/64	58	7/64	37	4
4	1/16	51	3/64	55	7/64	32	4
5	5/64	47	1/16	53	1/8	30	4
6	—	44	1/16	52	9/64	27	5
7	—	39	1/16	51	5/32	22	5
8	7/64	35	5/64	48	11/64	18	6
9	7/64	33	5/64	45	3/16	14	6
10	1/8	31	3/32	43	3/16	10	6
11	—	29	3/32	40	13/64	4	7
12	—	25	7/64	38	7/32	2	7
14	3/16	14	7/64	32	1/4	D	8
16	—	10	9/64	29	17/64	I	9
18	13/64	6	9/64	26	19/64	N	10
20	7/32	3	11/64	19	21/64	P	11
24	1/4	D	3/16	15	3/8	V	12

*Sizes of holes recommended for average application. Slightly larger or smaller holes may be required.

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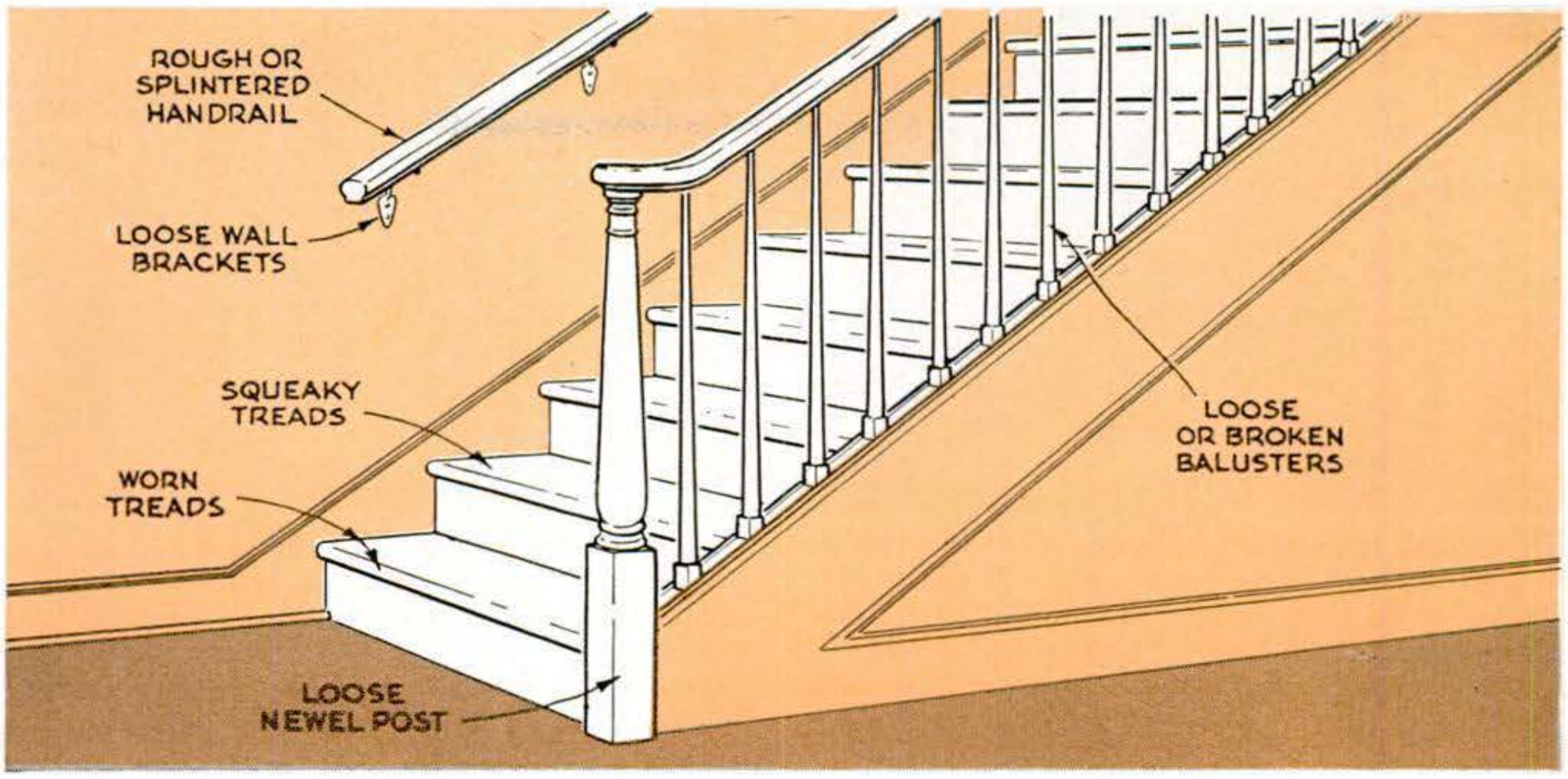
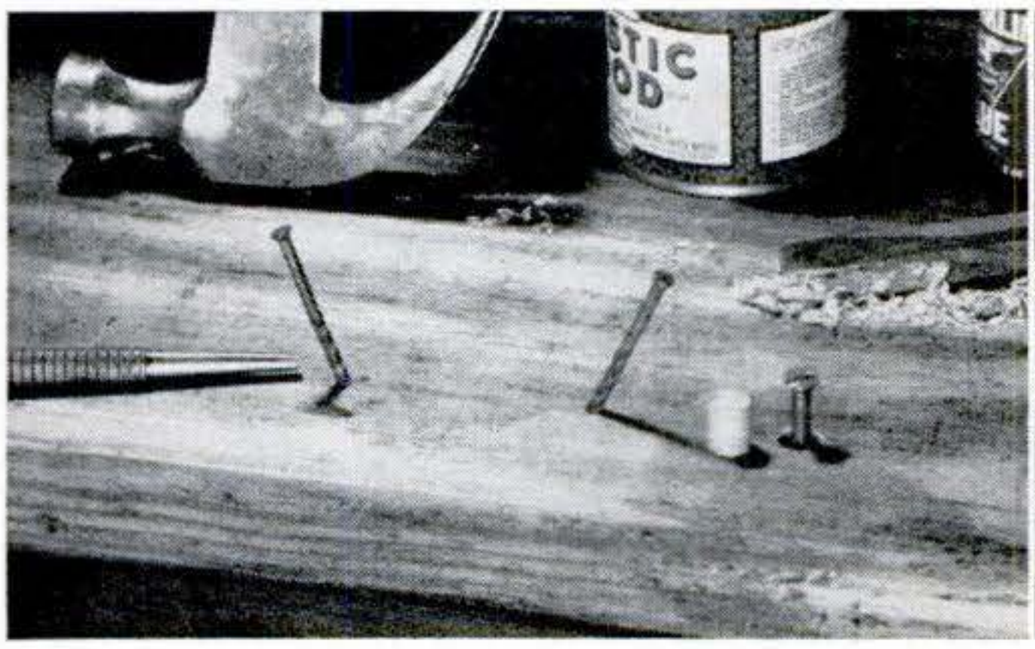
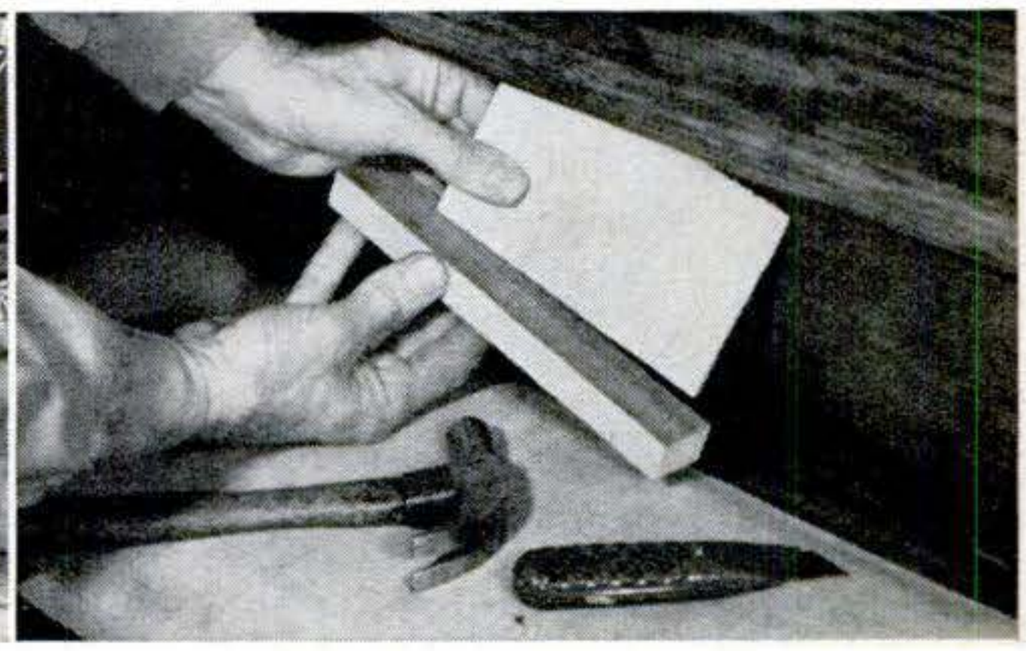
Stairways

fix-it file



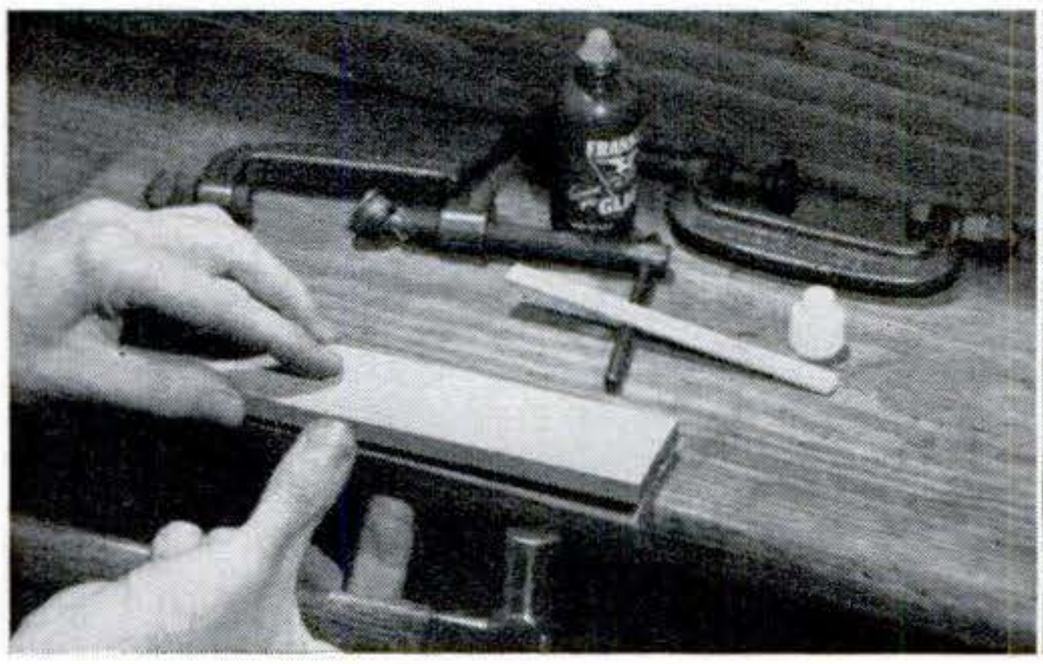
How to silence squeaks

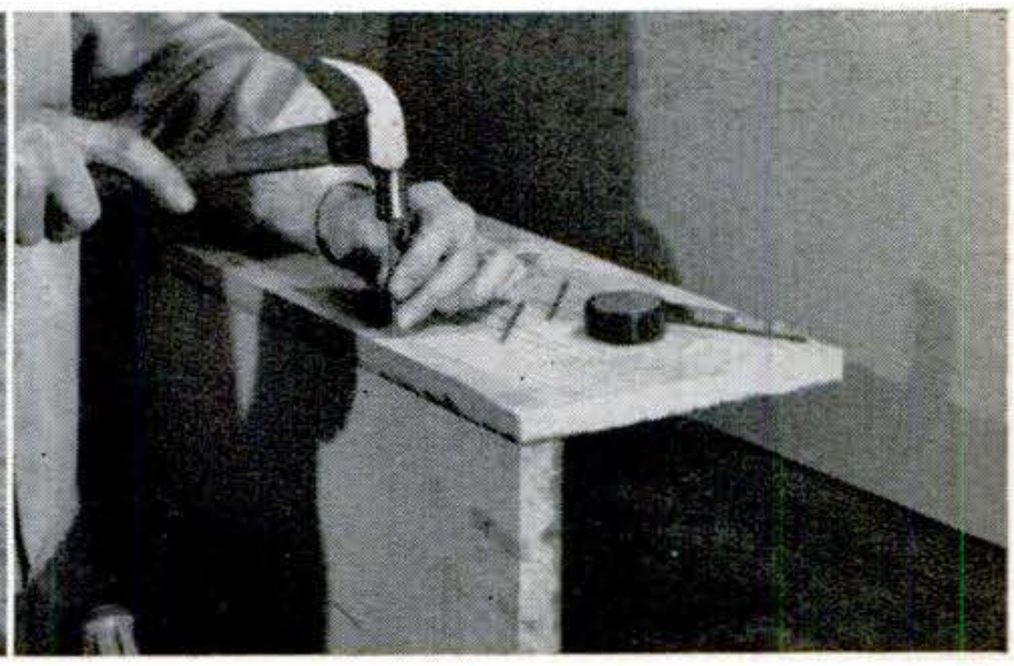




TO CURE A SQUEAK caused by friction between the tread and riser, drive helically grooved nails at an angle through the tread to the riser, or long wood screws covered with plugs that match the tread. A thin glue-coated wedge (right), driven into the joint where the riser is recessed into the tread, will sometimes help. When the underside of stairs is accessible, existing wedges can be driven tighter or glued and nailed.

How to repair worn treads





BADLY WORN EDGE, or nose, of a tread, result of heavy traffic or prolonged use, can be built up by chiseling out a recess and gluing in a new piece of hardwood. Plane it flush and round its edge to fit the original contour, and finish it to match the surrounding wood.

IF IT'S DAMAGED BEYOND REPAIR, the whole tread must be replaced. Remove the old tread and use it as a pattern. Here, a new tread and riser are being assembled and stained to match the stairway. Next step is to slip it into position and fasten with screws.

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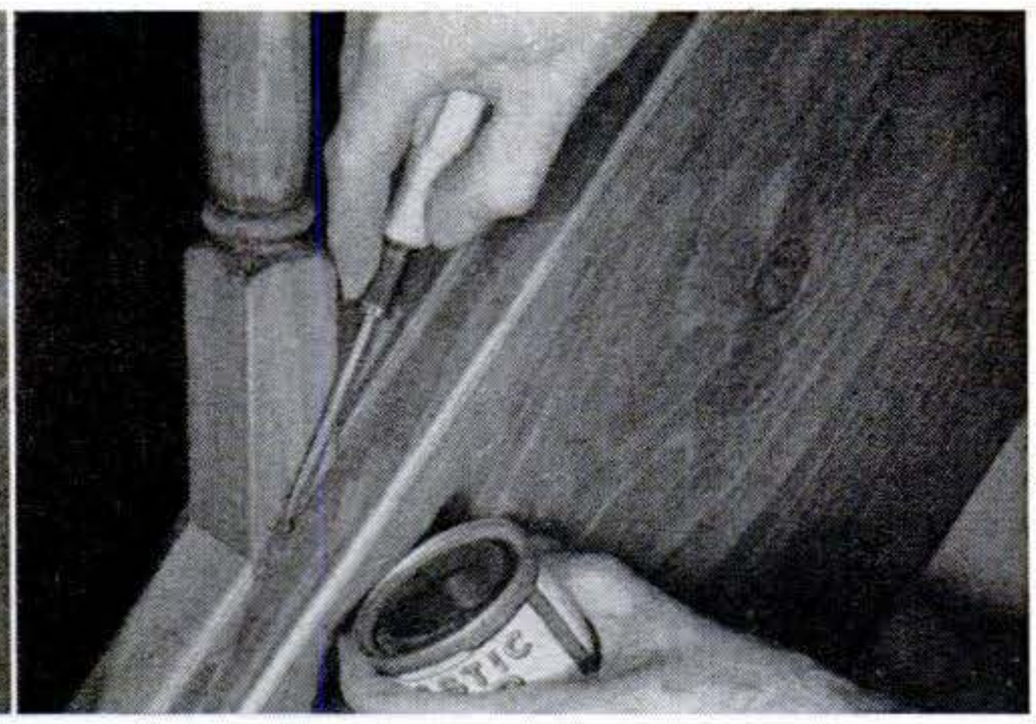
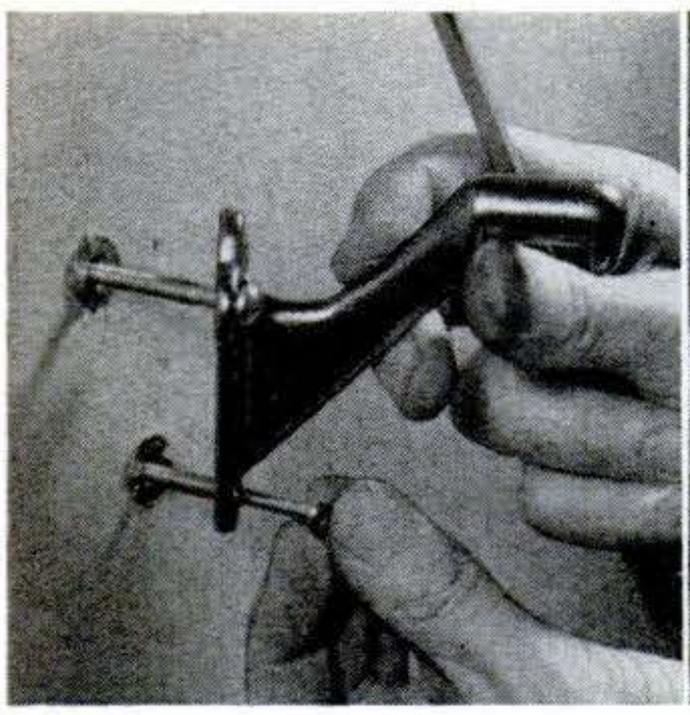
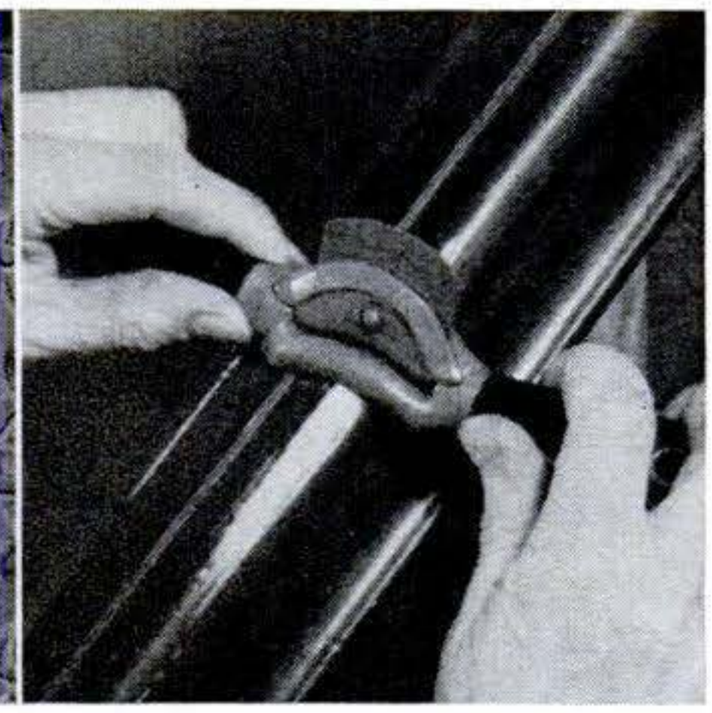
Cures for shaky handrails

A LOOSE HANDRAIL is often traceable to its main support—the newel post. If space permits, work glue in behind the post and draw it up tight with one or two long screws. If necessary, counterbore deeply for the screw head and fill the hole with a matching plug.



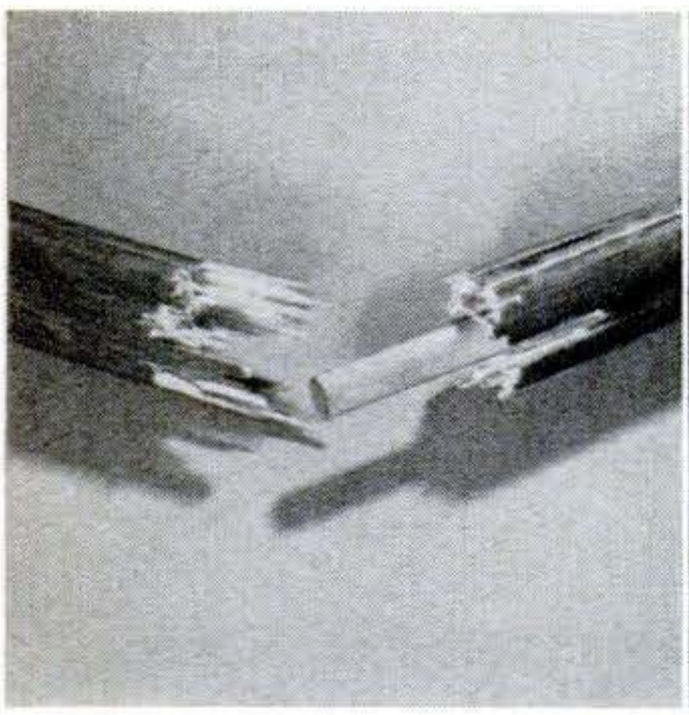
LOOSE BALUSTERS can give a handrail a wobbly feel. The sure cure is removal of filler strips so baluster can be glued and nailed, but a filler material such as plastic wood can be used to eliminate a small amount of play. Tamp it into the crack a little at a time.

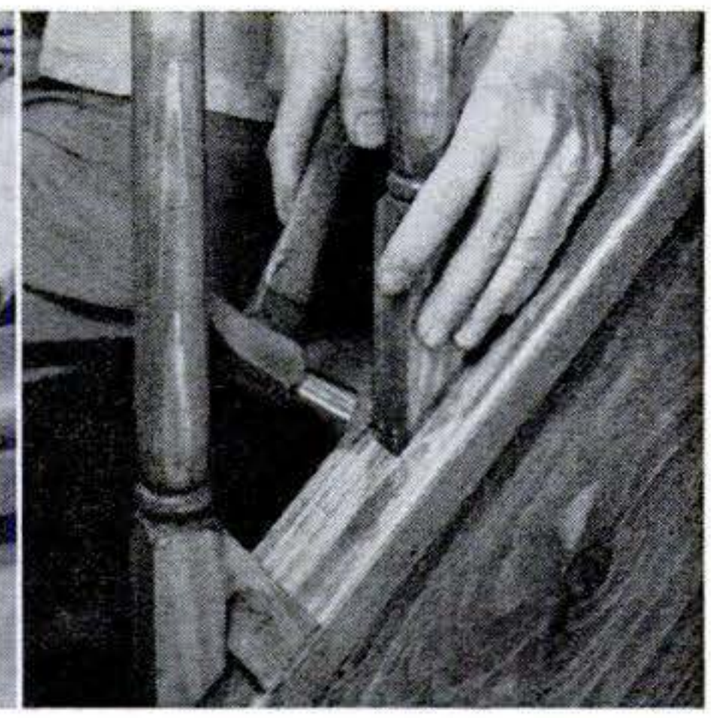




WALL BRACKETS that hold handrail may come loose because screws did not strike studs. Ream out screw holes and install expanding-type anchors or toggle bolts in the wall. The bracket can then be drawn up tight with the screws that come with the anchors. A shield (center) cut from thin hardboard or metal will cover old screwholes or wall damage caused by shifting the bracket. Smooth a splintered rail with a hand plane or spokeshave (right), sand with fine-grit paper and refinish to match the opposite rail.

Repairing a broken baluster





EASIEST WAY to repair a broken baluster is to have a cabinet shop turn a new one. But many breaks can be mended. Reinforce the repair by boring a loose-fitting hole in each part for a dowel (left). Partly fill the hole with glue and coat the splintered ends, then bring the parts together. Tie the splinters down by wrapping them with waxed twine and clamp the baluster on a board to hold alignment (center). When dry, remove the twine, sand smooth, and refinish before nailing the baluster in position.

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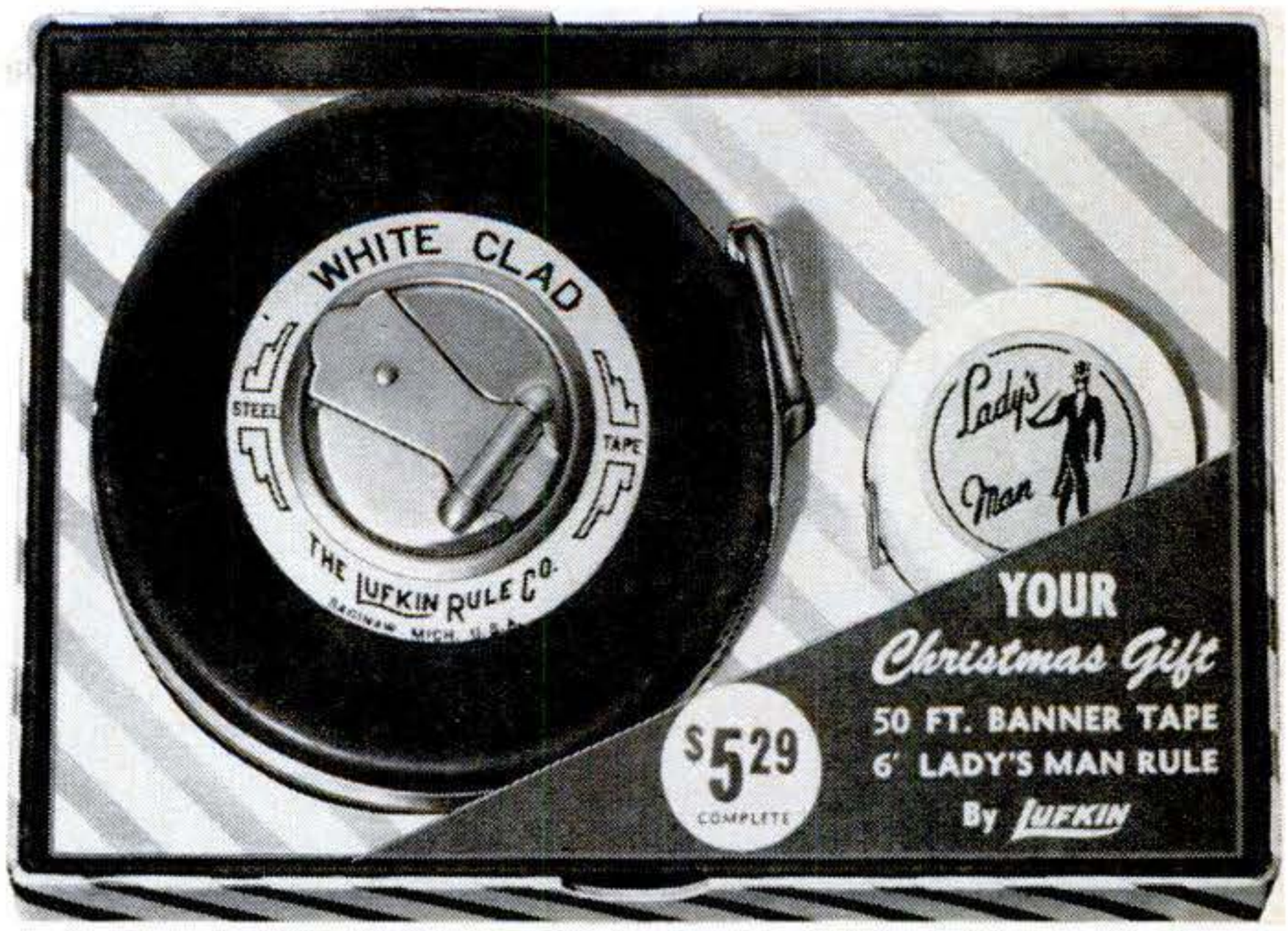

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AMAZING, PERMANENT, NON-ELECTRIC. HIGHLY PRACTICAL.
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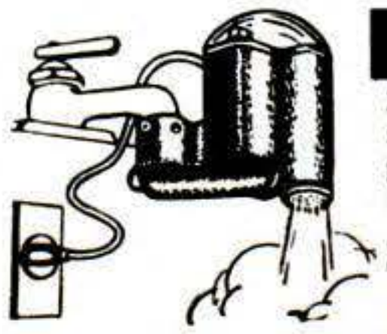

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Factory price . . . . . .

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HEAVY DUTY D-C ARC WELDER

Use as portable or shop welder. Up to 300 amps, Senior model. Made for years of trouble-free, continuous service. Will handle light or heavy jobs. Easily welds up to ¾" plate using ¼" rods. Built-in air cooling system. Arc is easy to strike and hold, because of specially designed arc stabilizer. Hi-lo switch and dial control gives wide range of welding heats. Run welder at 2600 rmp. with tractor, jeep or 15 hp. gas engine, or 7 hp. and triple V belt or flat pulley. You can pay more, but you can't buy a better welder. Wt. 110 lbs. $400.00 value..... **$119.50**
WELDING KIT Two 10 ft. leads, welding helmet, electrode holder, ground clamp. Sold only with welder at..... **$10.50**

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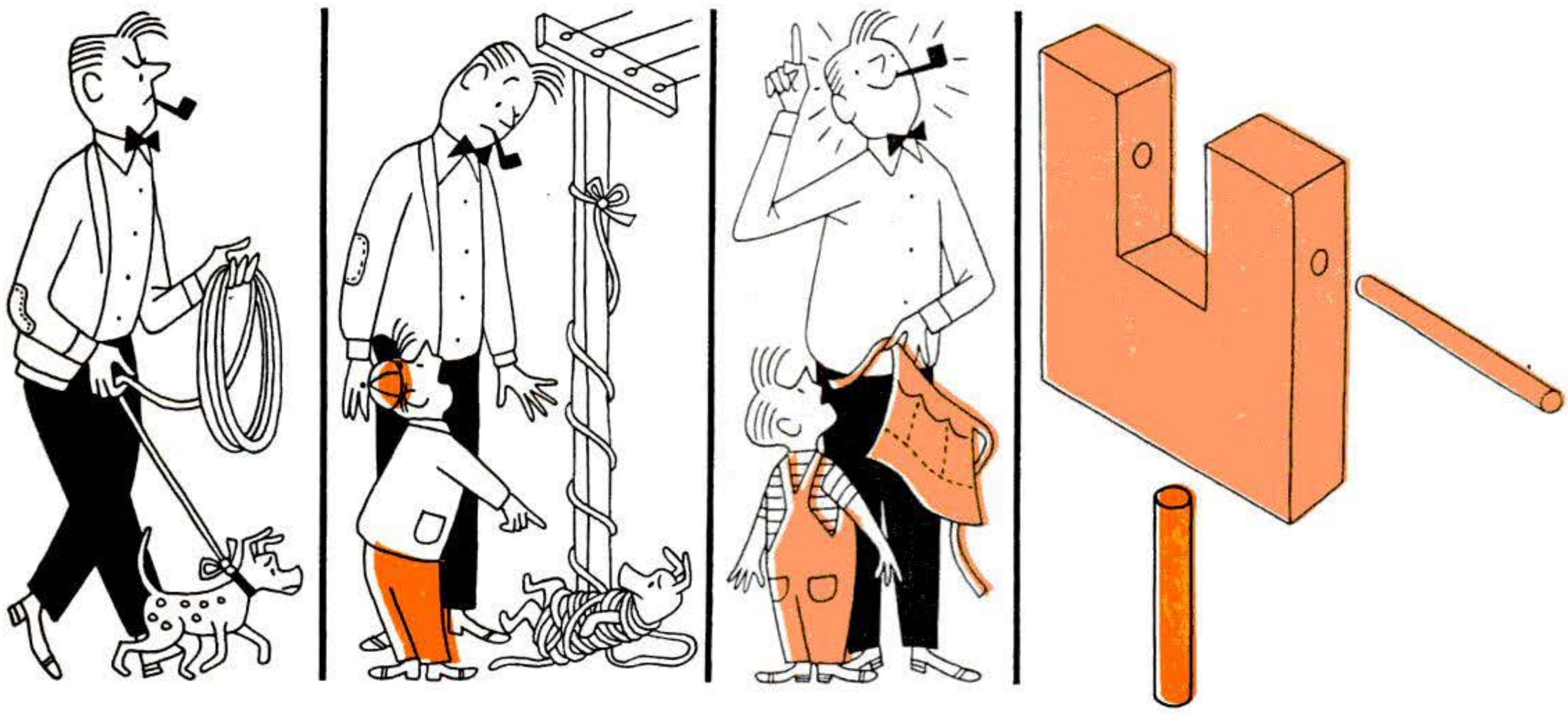
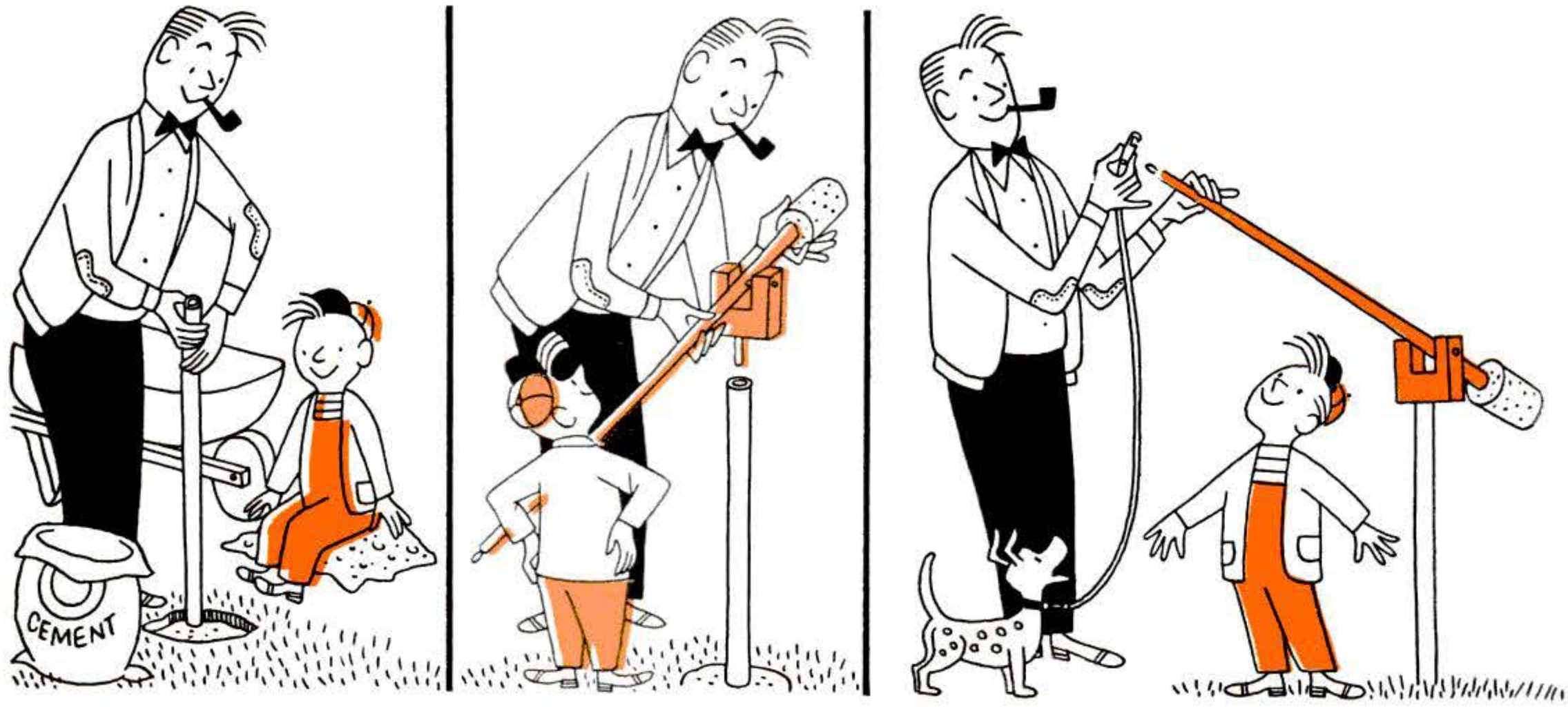
Wordless Workshop

By Roy Doty and Hi Sibley





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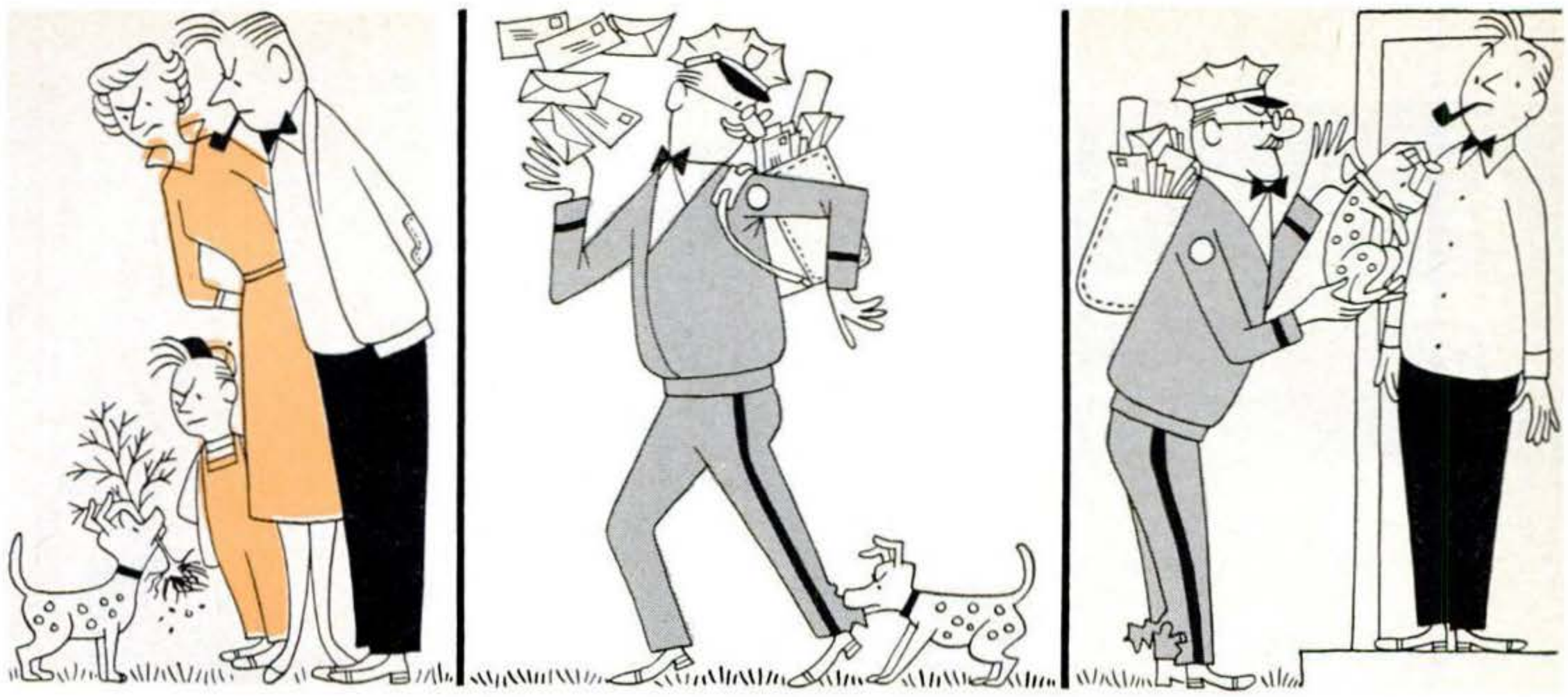

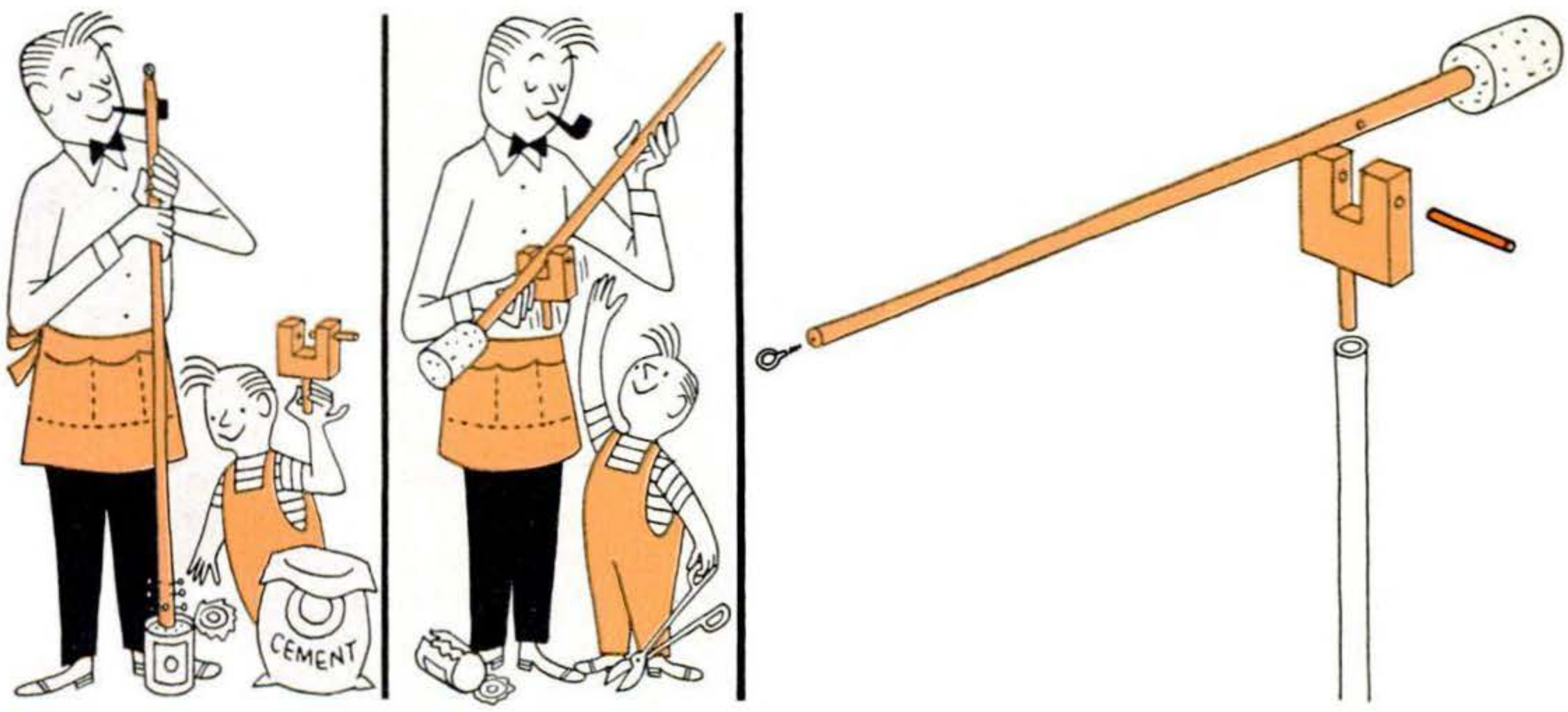

Next Month: A sliding shop light that moves anywhere you want it

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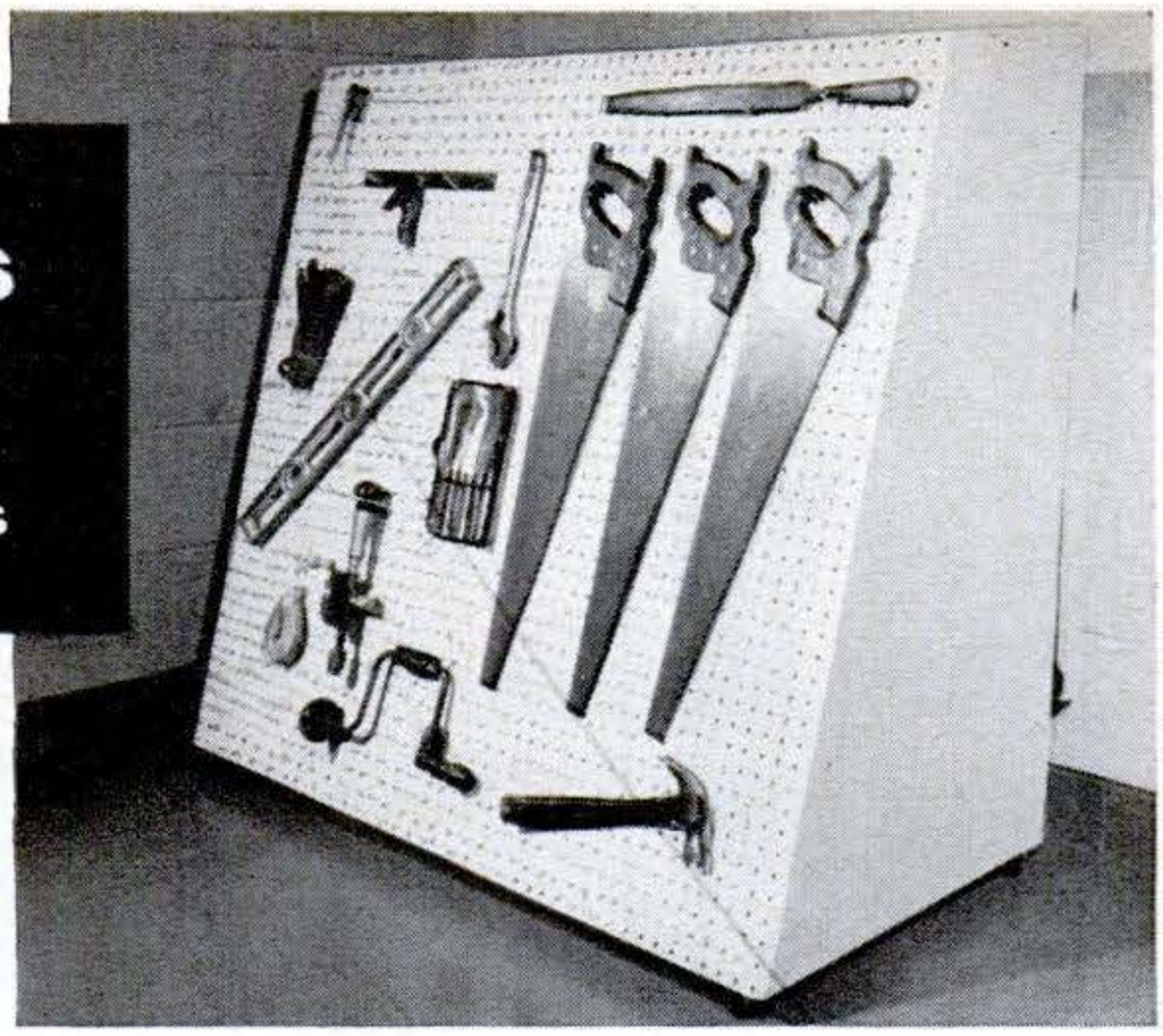
Short Cuts and Tips

FROM PS READERS



PERFORATED BACK slopes so tools hang snugly against it, won't swing away and fall off when the bench is rolling. Tools are held to back by typical wire hangers.

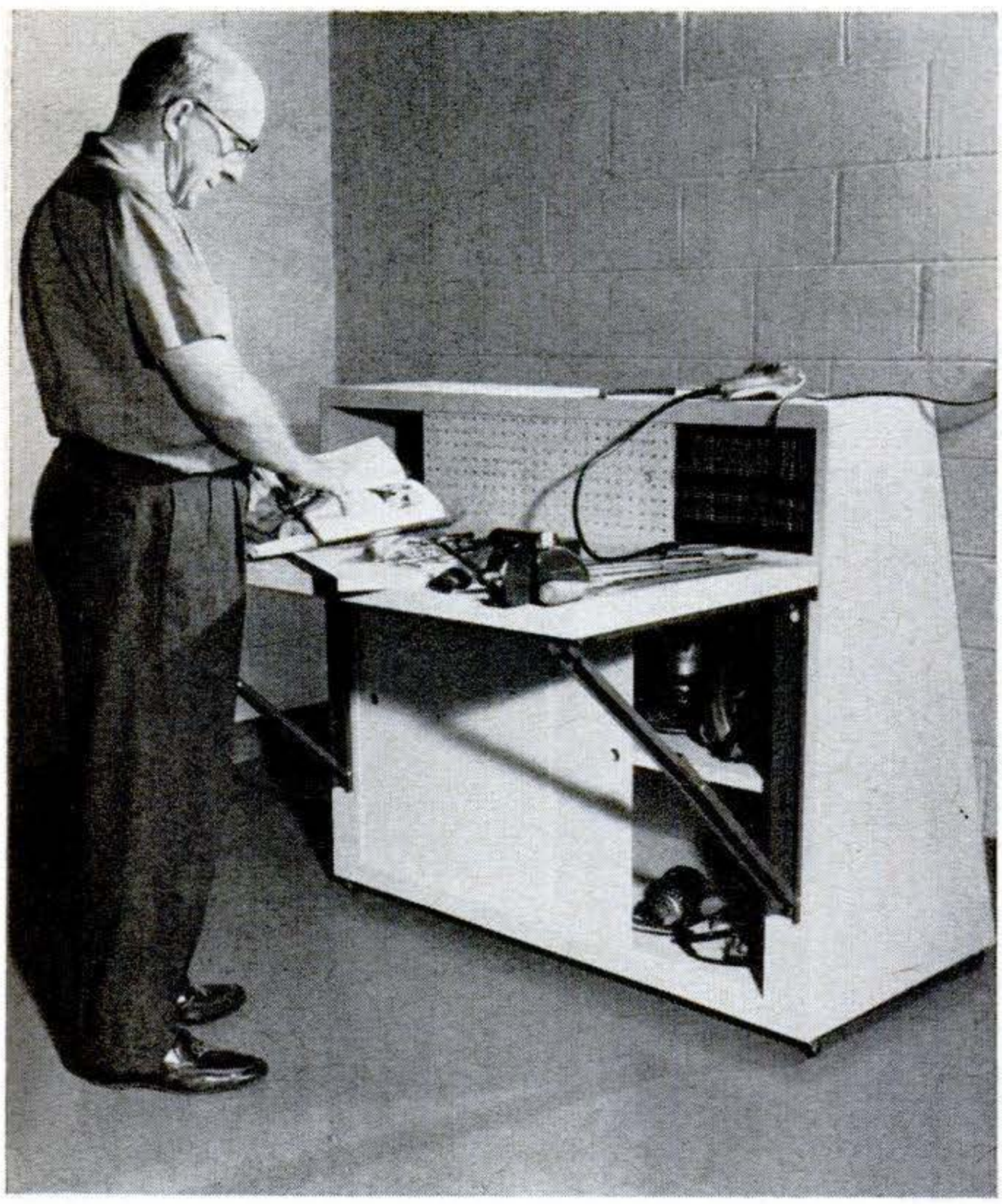
Roll-Around Workbench Totes All Tools to the Job

EVER wish you could move your shop to the job and save running back and forth for tools? With this mobile bench you can. Locking casters hold the bench steady when work's to be done. Released, they permit rolling the fully equipped shop back to the garage or basement.

The cabinet is simply a frame of one-by-twos covered with tempered Masonite. Sturdy folding brackets support the work surface—also a hardboard-covered frame—and swing it down flush with the face of the cabinet when not in use. Sliding doors above and below the work surface provide safe storage for tools and reference books. The doors move in grooves cut in the frame and can be fitted with cabinet locks if desired.

The most-used tools are hung on standard wire hangers fitted into a perforated-hardboard panel that covers the back.

Basic dimensions of the shop bench are: overall height, 42″; width, 48″; front-to-back depth at top, 12″; at bottom, 24″, creating a slope at the back that keeps the tools from falling off their hangers when the bench is moved. The work surface is 22″ by 46″. It is mounted on its supporting brackets at a convenient height for working, 30″ from the floor.—*Maynard Krueger Sr., Gary, Ind.*



DROP-LEAF WORK SURFACE is suspended at bench height by hinged brackets having a diagonal arm that folds on a pivot.

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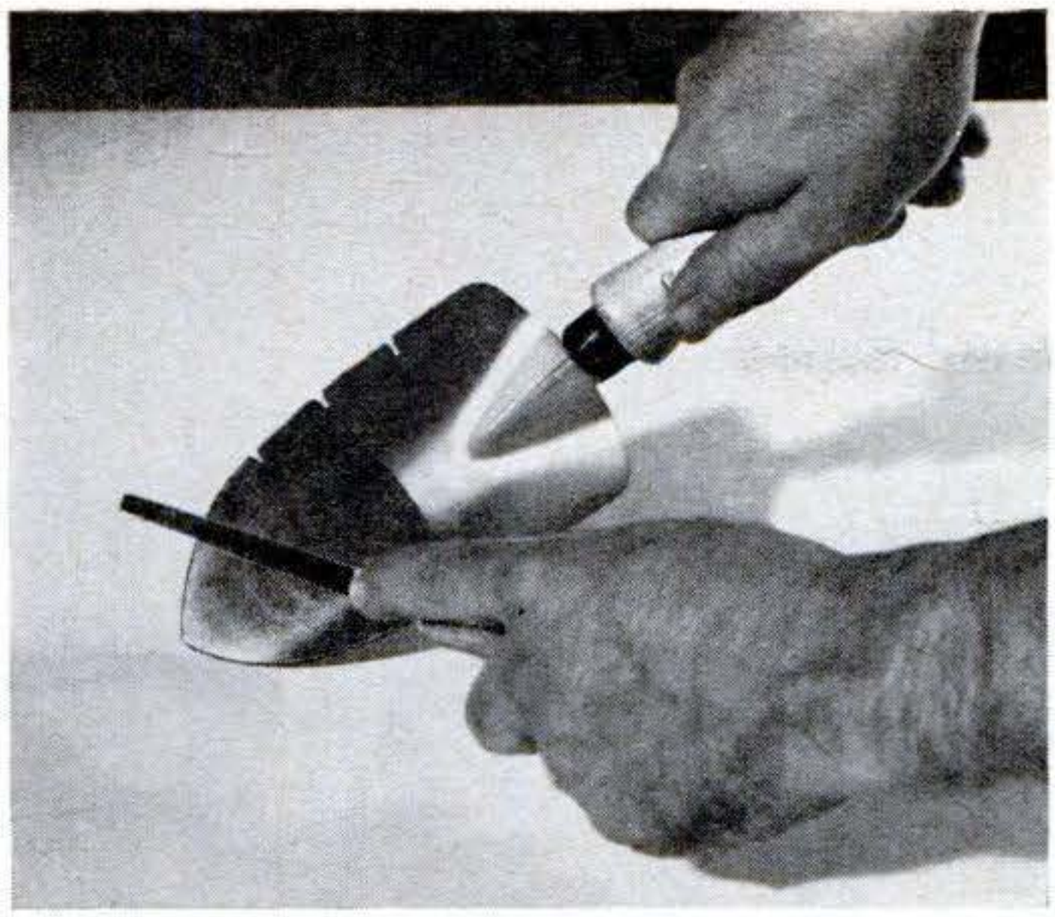
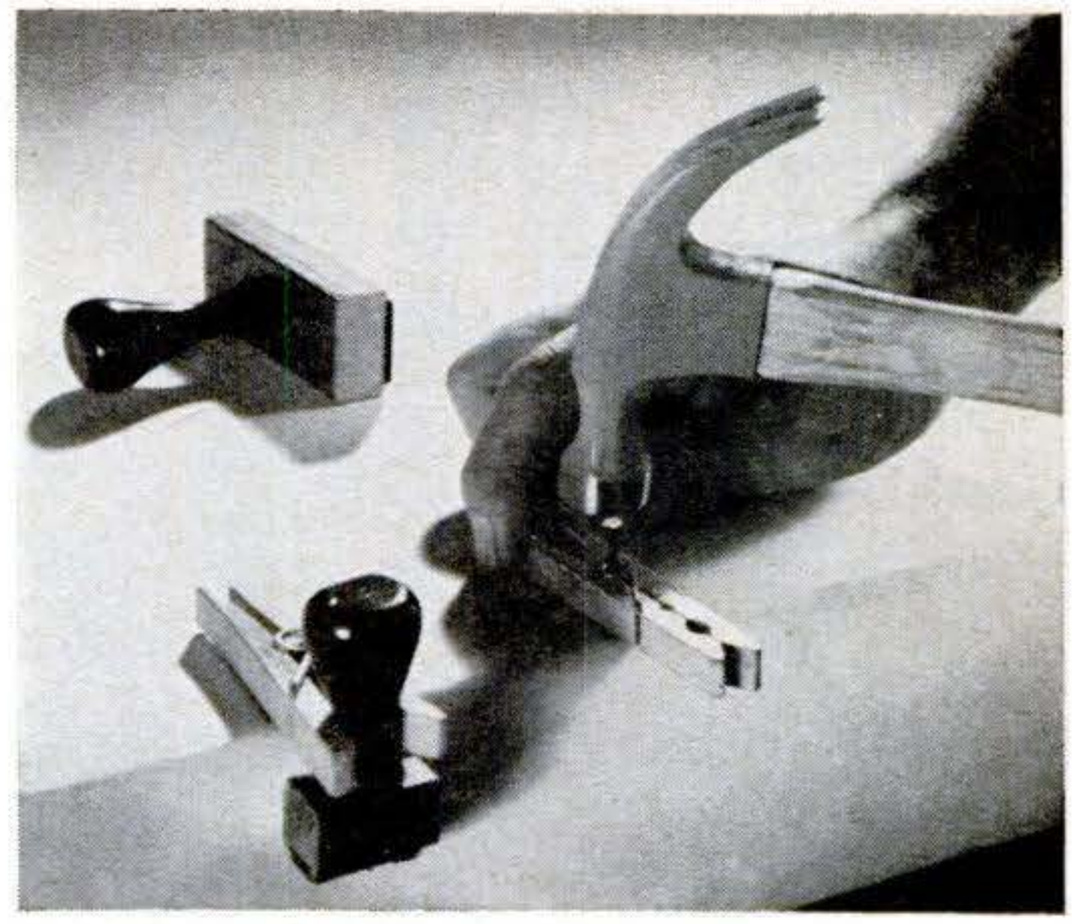


Depth-Indicating Trowel

PLANTING seeds and bulbs is a much simpler task if you file marks along one edge of the garden trowel to indicate depth. Marks an inch apart, for a distance of four inches, are handiest.

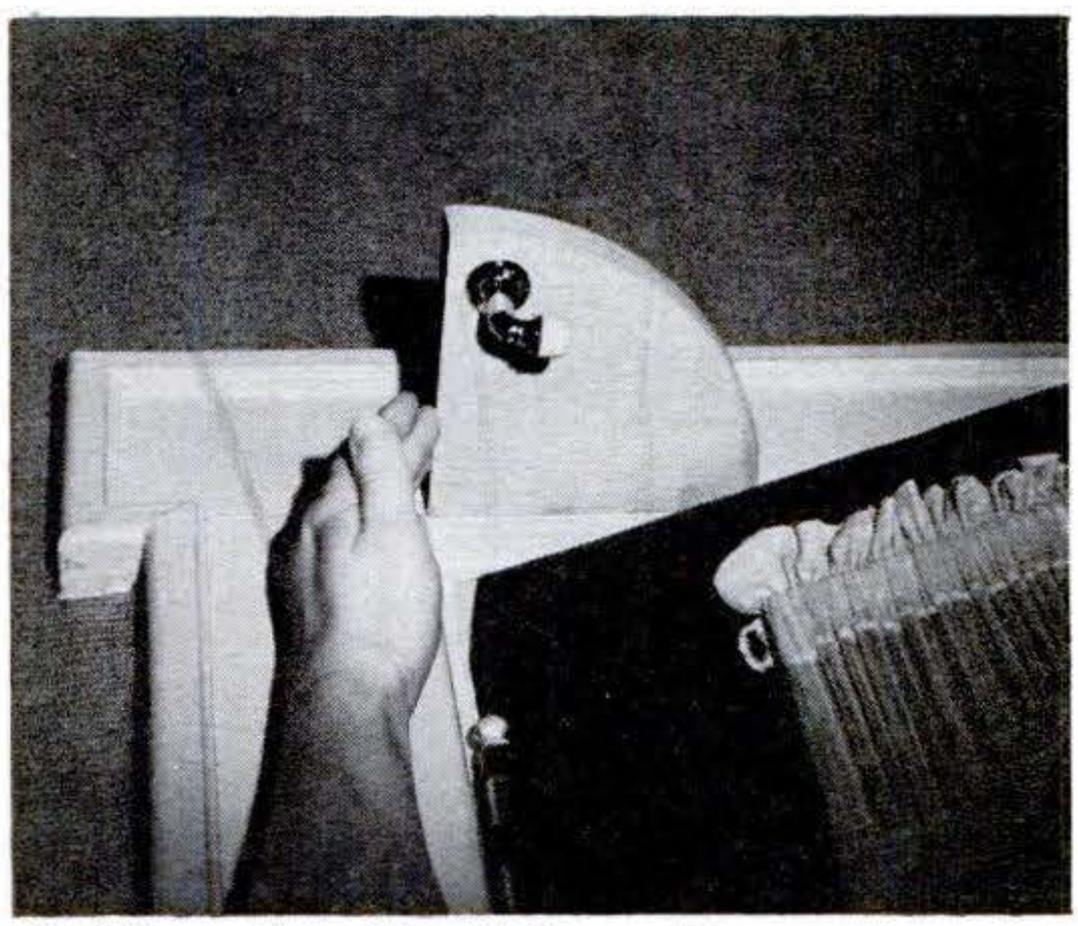


Rubber-Stamp Holders

SPRING-TYPE clothespins are made to order for holding rubber stamps. You can fasten the holders to the edge of a shelf by driving a small common nail through the hole in the clothespin spring.

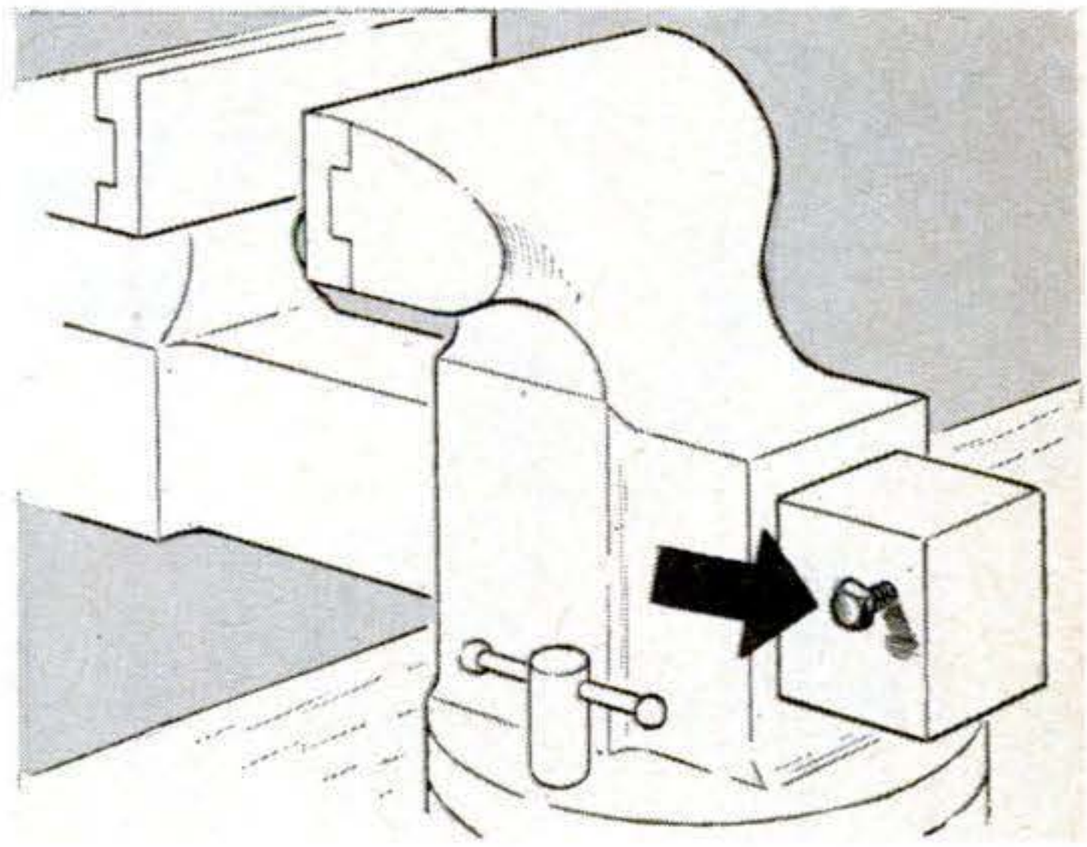
► I prevent air bubbles from forming on camera film during development by first soaking the film in water for a minute. Bubbles cause undeveloped spots on the negative, visible as dark specks on prints.—*Avrom Weinberg, Milwaukee.*

► Hammering the wooden handle of a chisel won't split it if you screw or tap a furniture glide onto the end. Use a glide having a single screw or prong and a diameter about the same as that of the handle.—*Arthur Field, San Francisco.*



A Stop for Problem Doors

SOME doors bang against radiators, bathtubs or another door when opened. If a stop can't be fitted to the door, you can usually limit the swing with an L-shaped stop overhead. This kind is screwed to a quarter-circle of wood that's fastened above the hinge side of the door by angle brackets. When painted to match, the wooden wedge will become inconspicuous. —*Frank A. Javor, Newark, N. J.*



Putting Safety Stop on Vise

EVER open your vise jaws all the way and suddenly find the movable jaw in your hand? To avoid this, drill and tap a hole near the end of the vise way (the sliding bar that supports the movable jaw) and install a bolt to prevent the jaws from being opened beyond safe limits. The bolt can be taken out any time a maximum opening is needed.—*Bill Welsh, Miamisburg, Ohio.*

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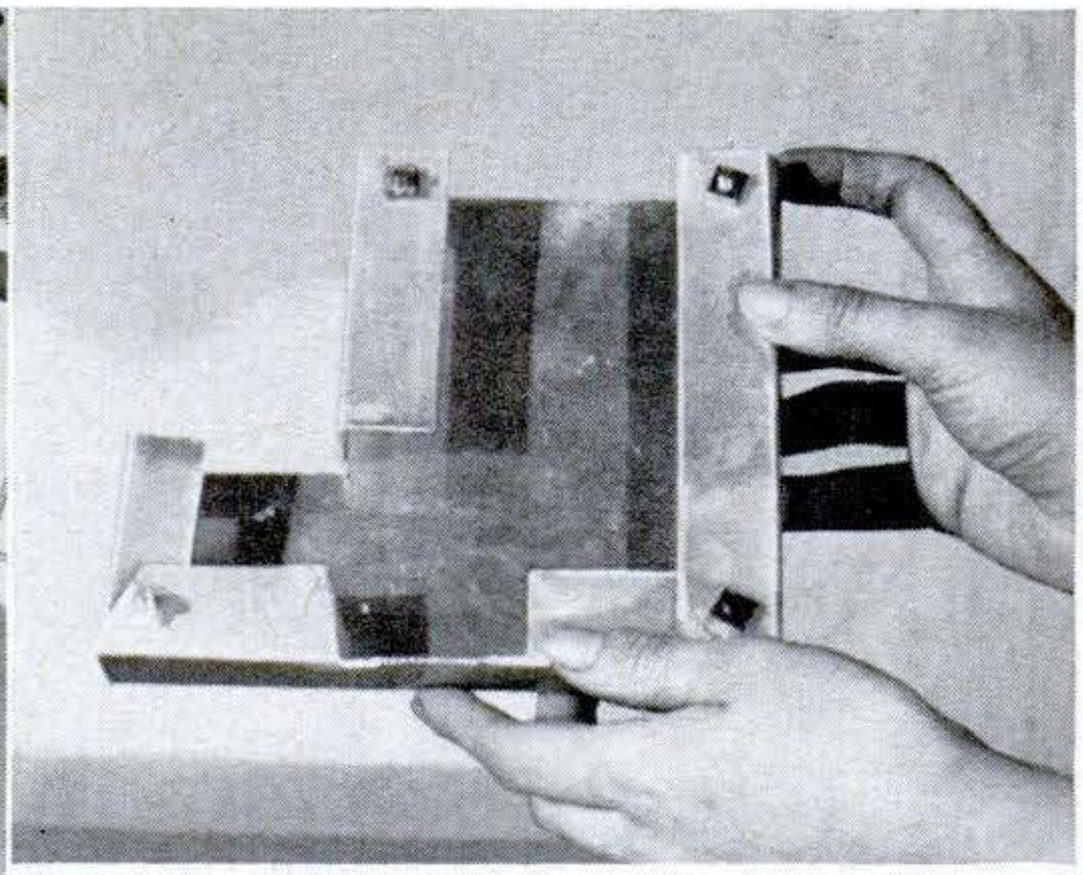
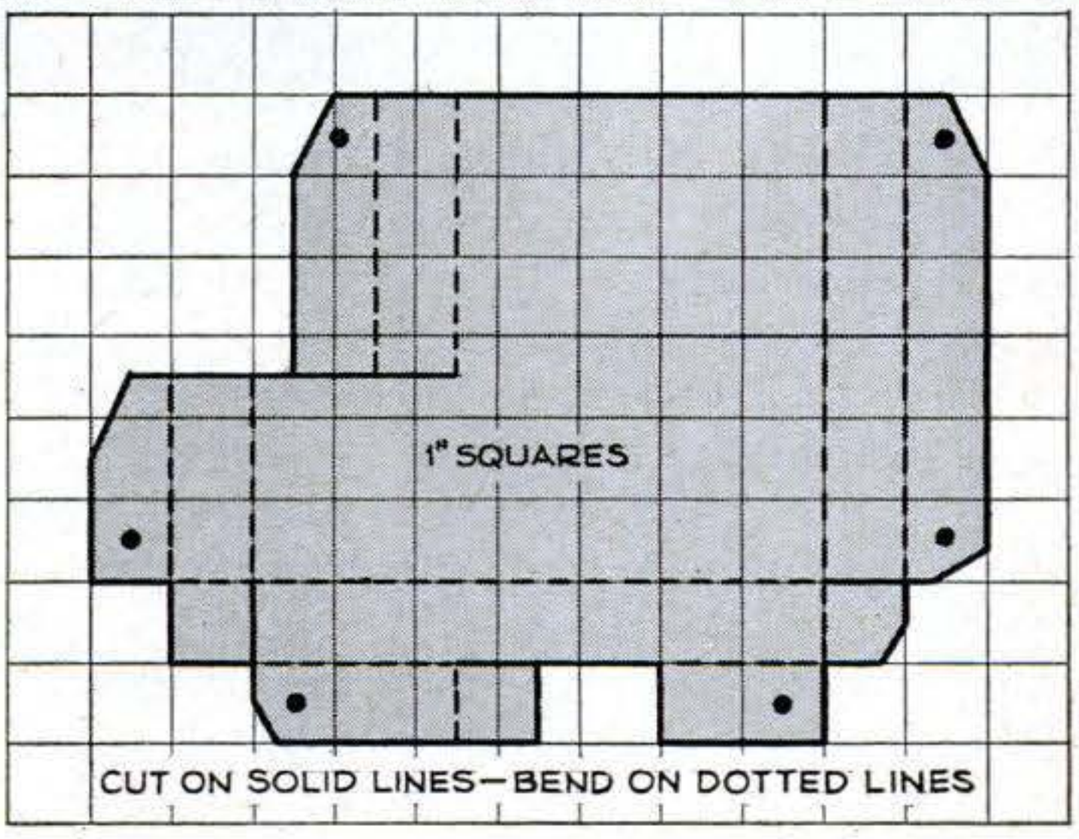
Short Cuts and Tips

Double-Decked Layout for Trains

SINCE there was not room to stretch out our Lionel layout, I extended it to a second level.

I attached the upper deck to two 2′-long four-by-fours and ran connecting track to the lower table on a continuous spiral around each post—two loops around one and one around the other. I mounted the spirals on arms screwed to the posts at intervals to give a pitch of ¾″ to a length of track. The spirals were made of ⅜″ plywood soundproofed with ½″ fiberboard. The track was laid out on each deck in a loop so the trains would always head forward whether they were climbing or descending.—*Harold V. Stark, Clarks Summit, Pa.*





Map Holder for Motor Scooter

BECAUSE road maps in my pocket were usually crumpled to illegibility before the end of a long scooter trip, I built a handy rack for them of light aluminum sheet, and included space for cigarettes.

Cutting the outline from the pattern at right, I folded the metal on the dotted lines and fastened it near the steering column with bolts.—*Robert Gannon, NYC.*

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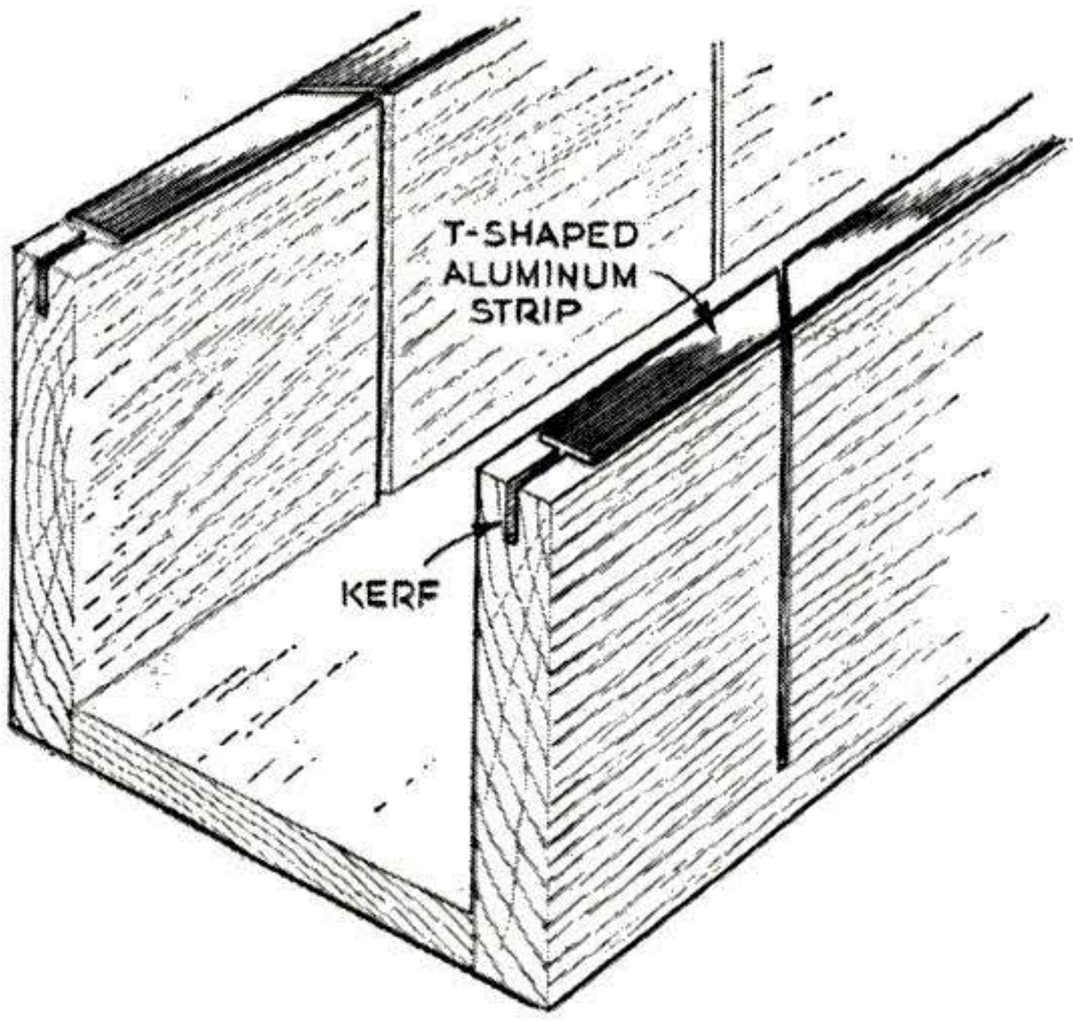
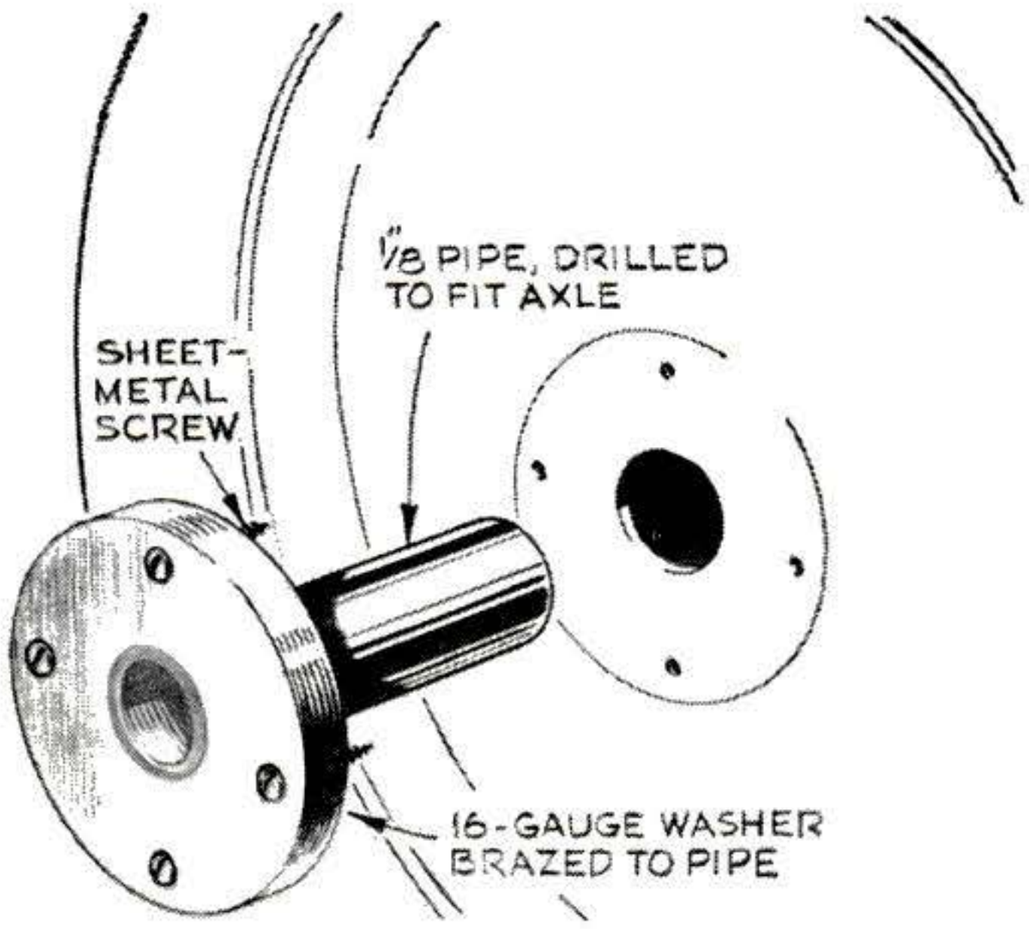


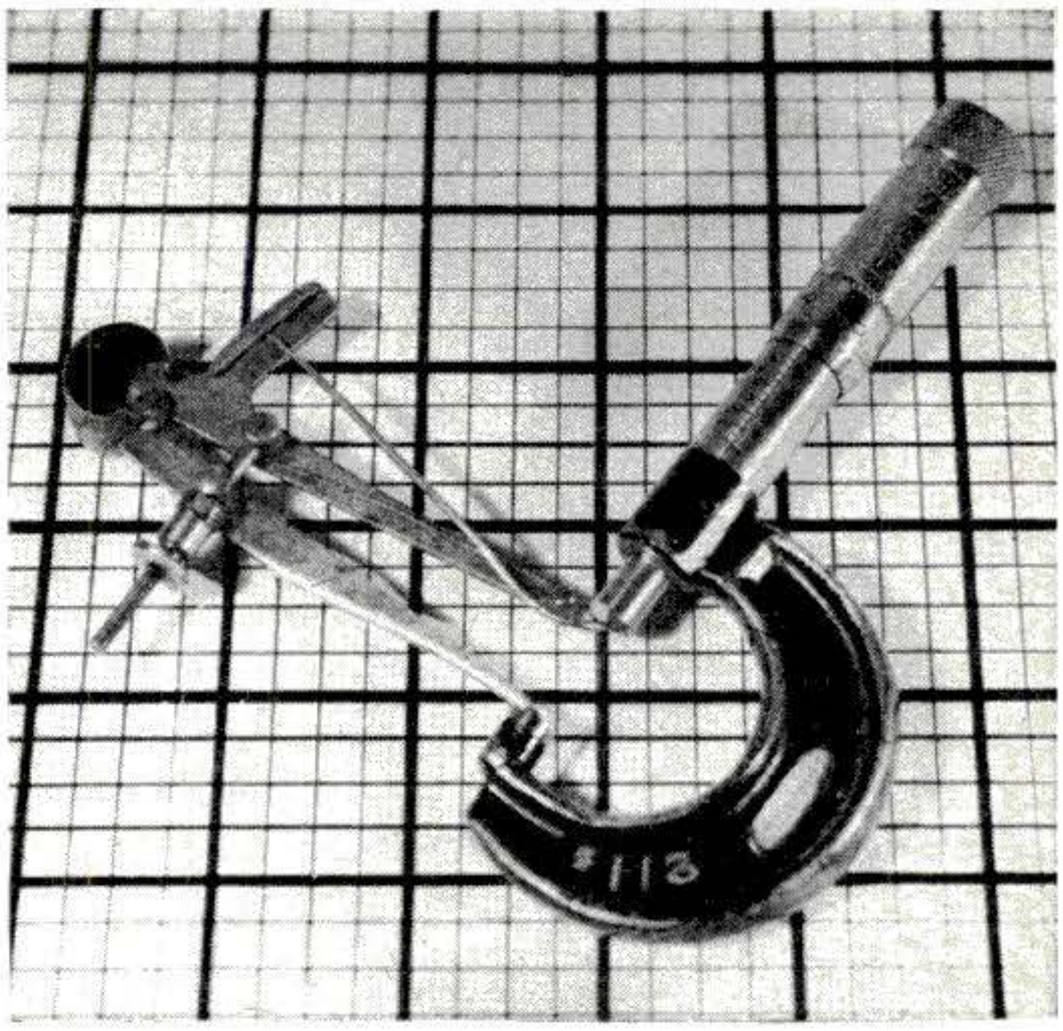
Keep a Miter Box Accurate

To KEEP a miter box accurate and prolong its life, saw a kerf lengthwise in the top edges of the box. Then cut two strips of T-shaped aluminum and cement them into the kerfs. Carefully saw through the aluminum into the guide slots, and you have finished the reinforcing job.—*N. M. Pittman, Overton, Tex.*



Fix-It for Toy Wagon Wheel

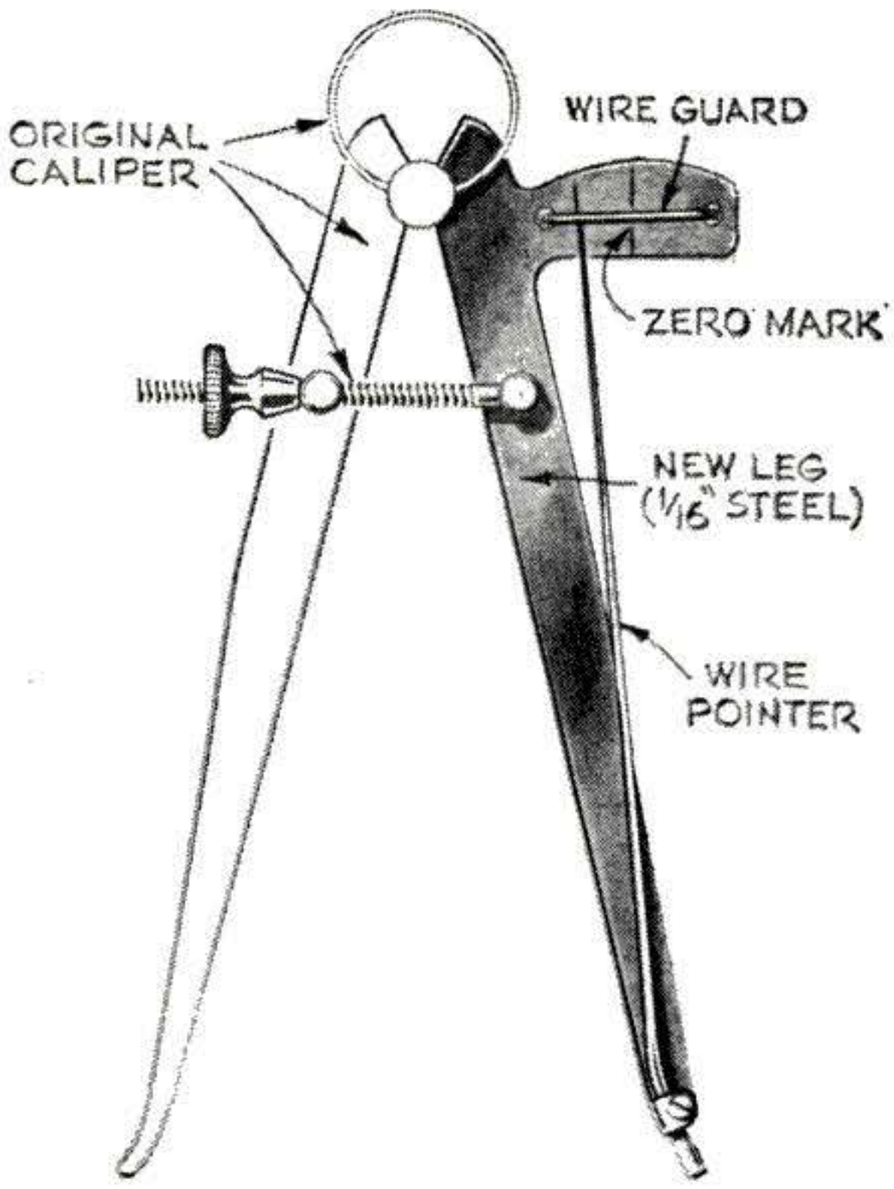
WHEN the wheel bearing of a toy wagon wheel gives out, here's how to replace it. Weld or braze a 2"-diameter steel washer to a short length of 1/8" pipe. Drill the inside of the pipe to fit snugly on the axle and make four screw holes in the washer. Remove the old bushing, center the new one and drill pilot holes in the wheel disk. Fasten the washer to the wheel disk with sheet metal screws, and cut the pipe to proper length.—*J. Hugh Capron, Winona, Minn.*



Make a Caliper Superaccurate

YOU can make an ordinary inside caliper more sensitive by replacing one leg with a special indicating leg cut from 1/16" sheet metal. A stiff wire pointer is pivoted at the bottom of the new leg to increase sensitivity.

To use the tool as a precision gauge for checking inside holes, you set the caliper with a micrometer so that the needle centers over the zero mark on the indicating leg. Then, when you insert the caliper in the hole, the needle will show the slightest deviation from its setting. To take an accurate inside measurement, adjust the caliper in the cavity until the needle swings to zero and read this adjusted setting with your micrometer.—*D. A. Rogers, Minneapolis.*



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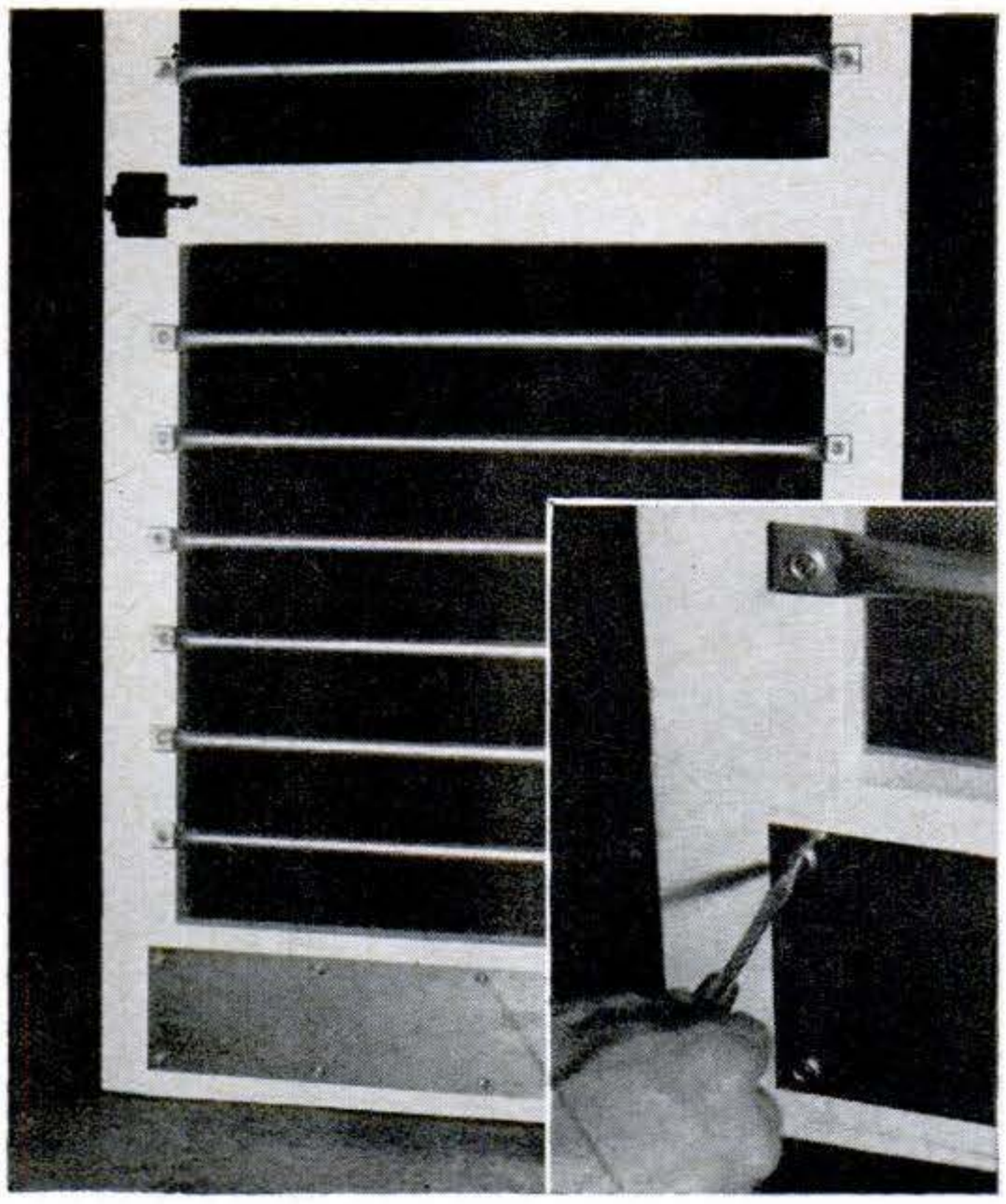
Short Cuts and Tips

Screen-Door Protection

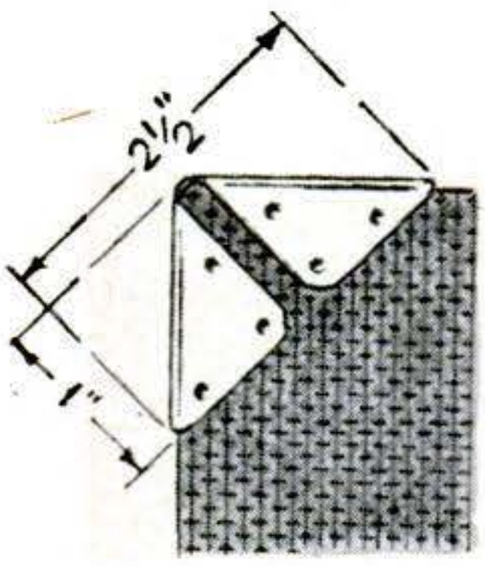
A STAINLESS-STEEL or aluminum kick plate and horizontal bars of ½″ thin-wall electrical conduit or aluminum tubing will ornament a screen door and prevent damage.

You can get kick plates cut to size at many small sheet-metal shops. Install one on each side. Cut the tubing 2″ longer than the opening, flatten the ends in a vise and drill for screws. I used No. 6 cadmium-plated, ovalhead wood screws with finishing washers on both plate and tubing.—*E. W. Kraft, W. Chicago, Ill.*



Protecting Hardboard Corners

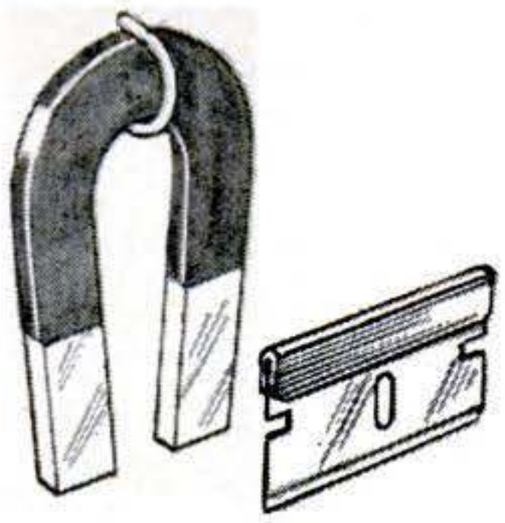
THE use to which hardboard may be put is often limited by the ease with which the corners and edges become damaged. In making blackboards and bulletin boards, I bind the corners with scrap aluminum, bending the metal over at the edges and fastening with dimples. —*E. W. McNamara, Fairfield, Conn.*

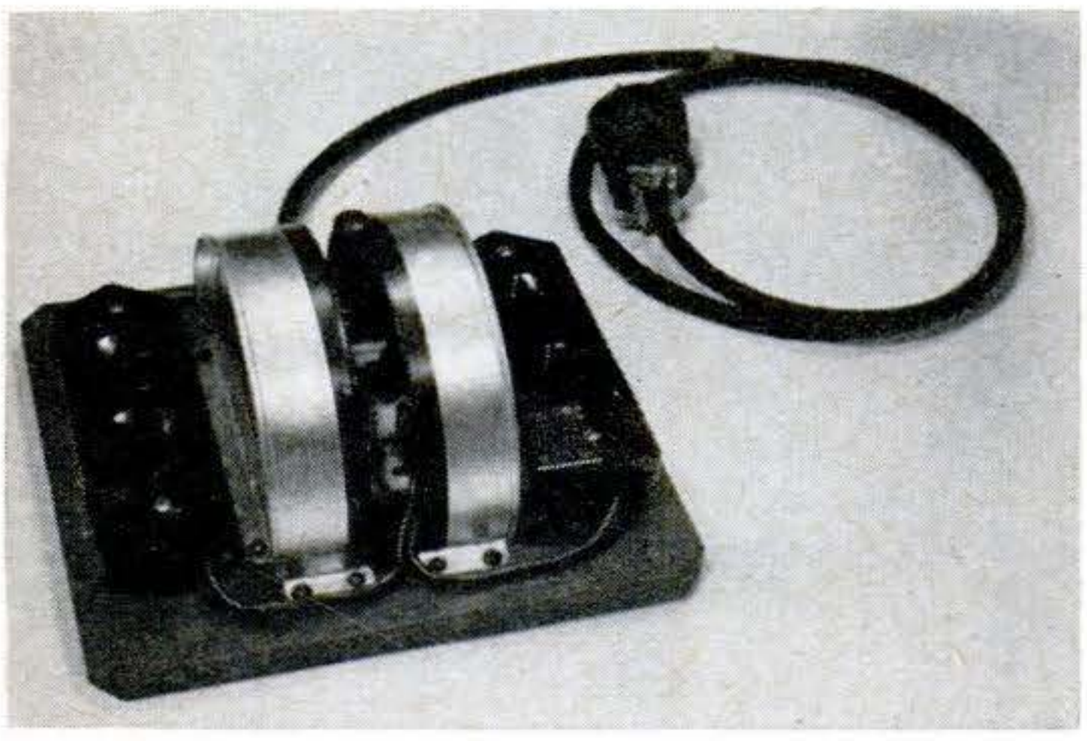


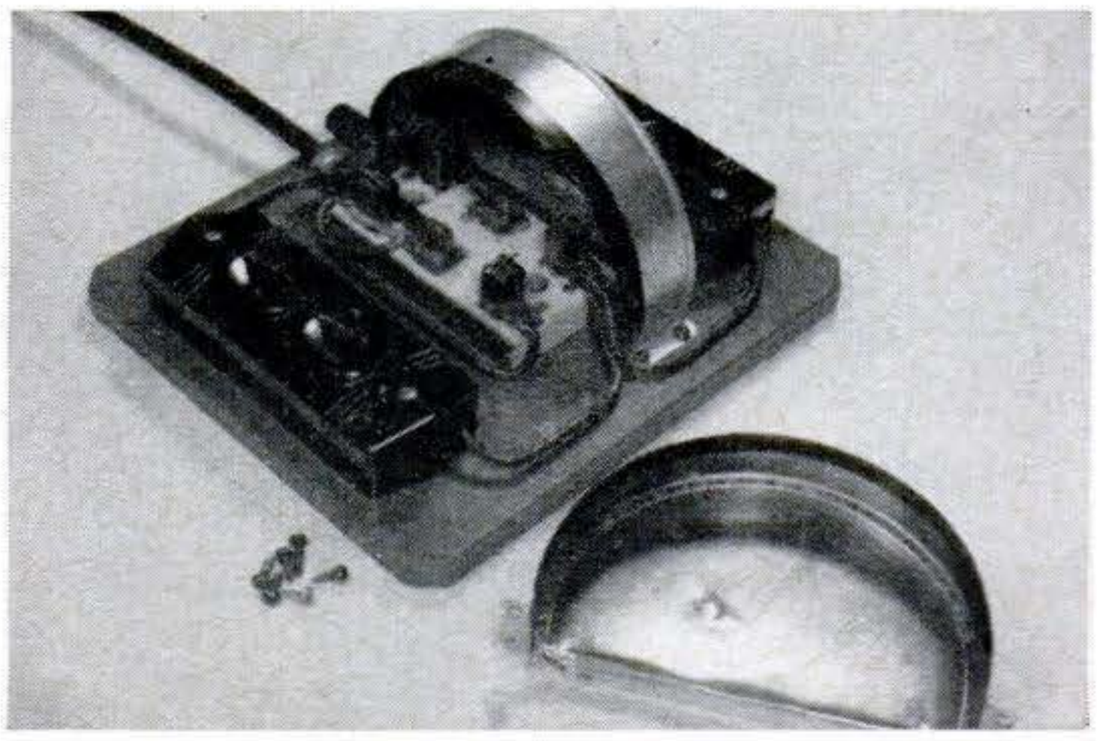
Magnet Holds Razor Blades

AFTER nicking my finger with a razor blade I had left loose in my workbench drawer, I bought an inexpensive horseshoe magnet and stapled it to the wall.

Any kind of magnet attached to a wall, tool board, drawing board or the like will keep blades out of the way.—*Thomas P. Morgan, Washington, D. C.*







Safeguarding a Knife Switch

A KNIFE switch can be protected by the bottoms of two cans of slightly greater radius than the length of the blades. Cut them into a little more than half-circles to allow sufficient clearance for the blades to pivot while still leaving room to grip the handle. Be sure to cover the edges of both with plastic electrical tape before screwing them down over the switch.—*Carleton A. Phillips, Corning, N. Y.*

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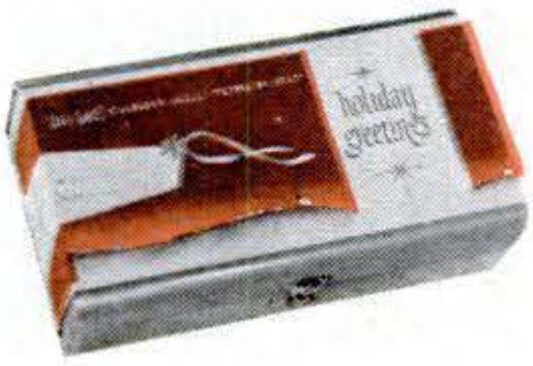

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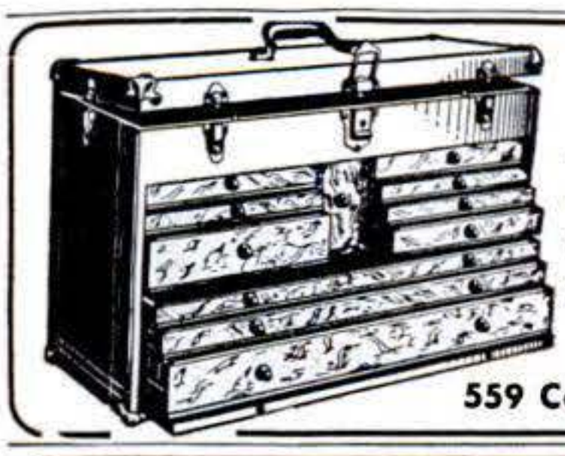

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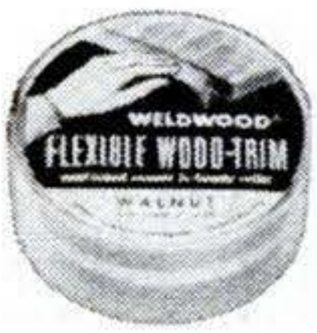

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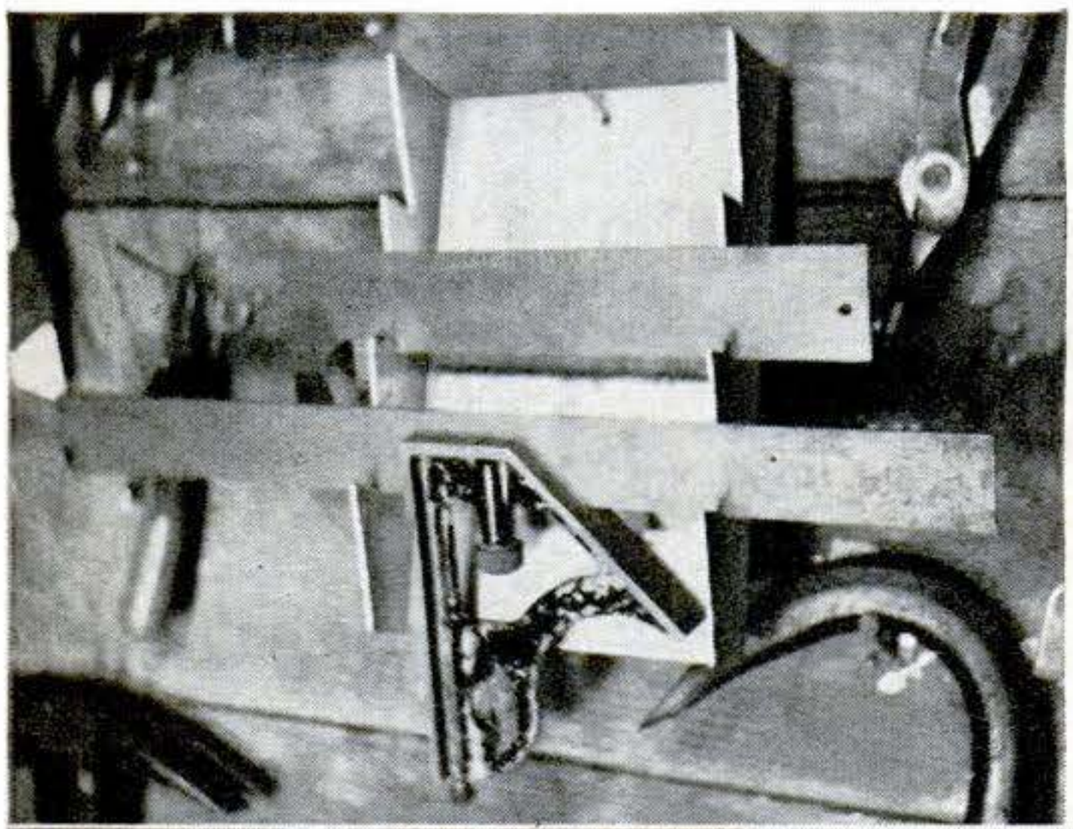
Short Cuts and Tips

Tractor Tool Box Saves Farm Time

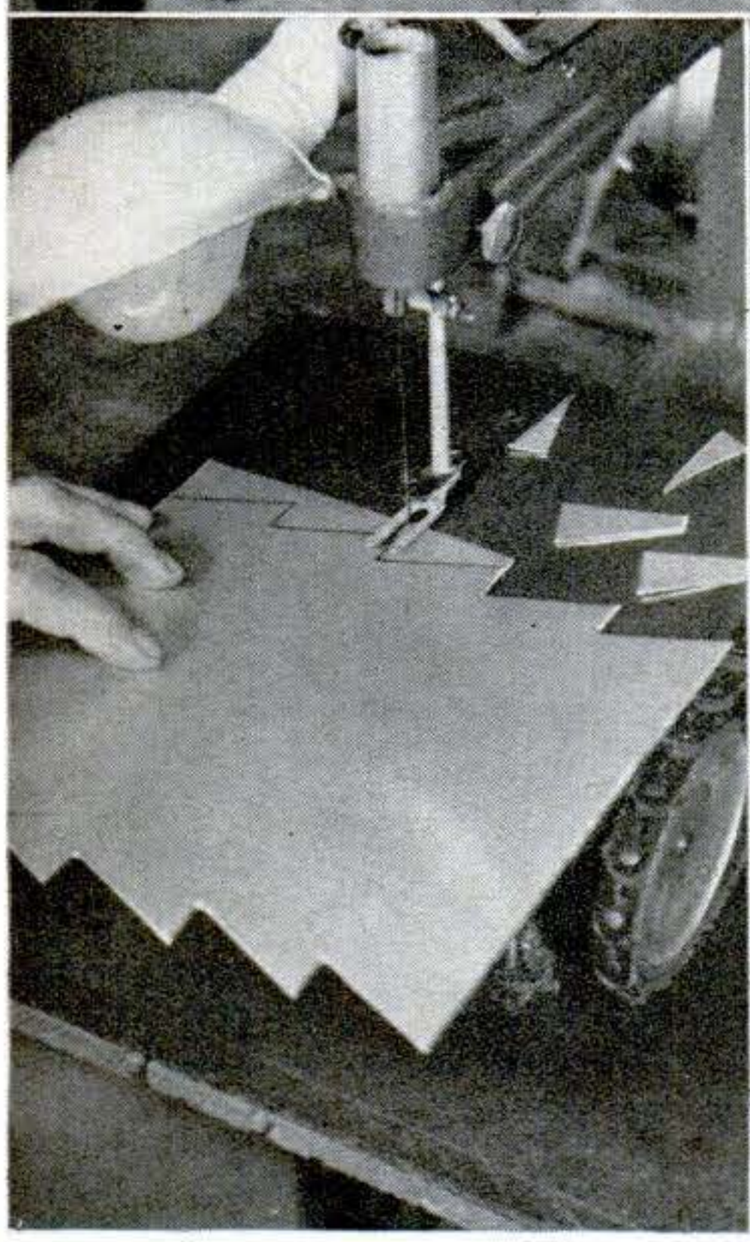
IF HIS tractor breaks down in a field, Morris Fleming, Iroquois County, Ill., can make a repair on the spot without a long trip to the farm shop. A large wooden box mounted on the tractor drawbar holds a variety of tools. They are handy to get at from the tractor seat or ground.—*Kenneth Imig, Watseka, Ill.*

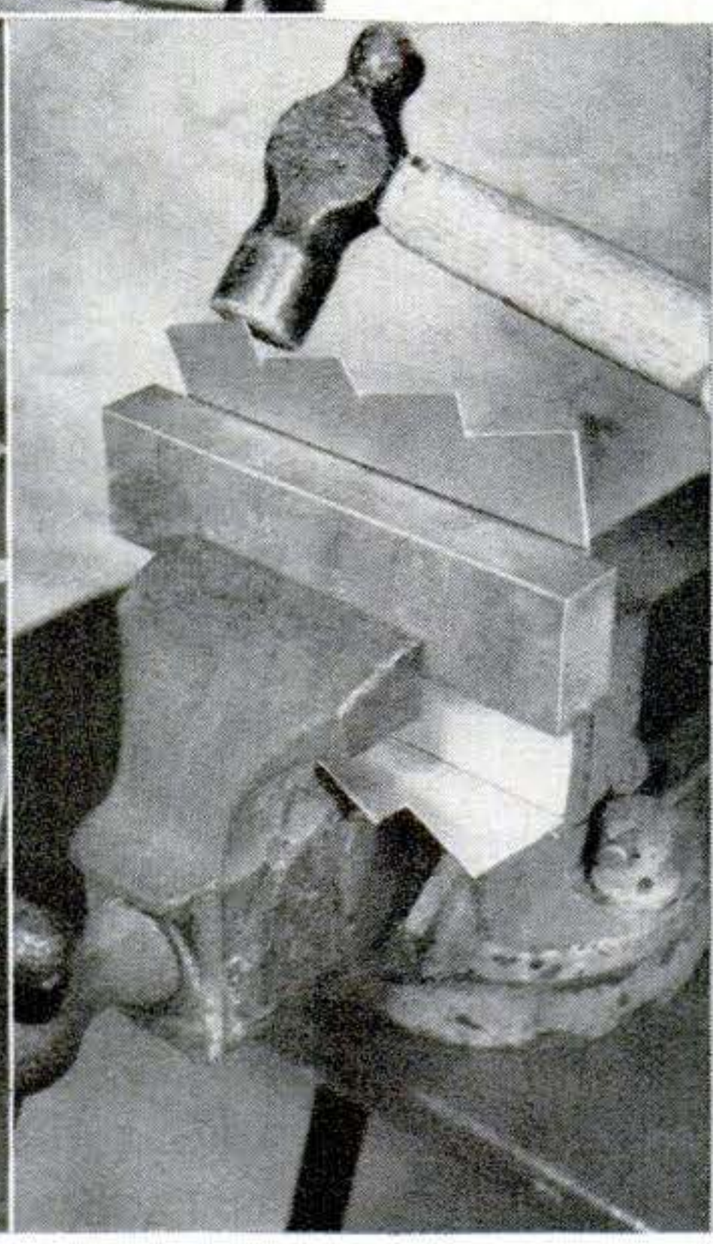


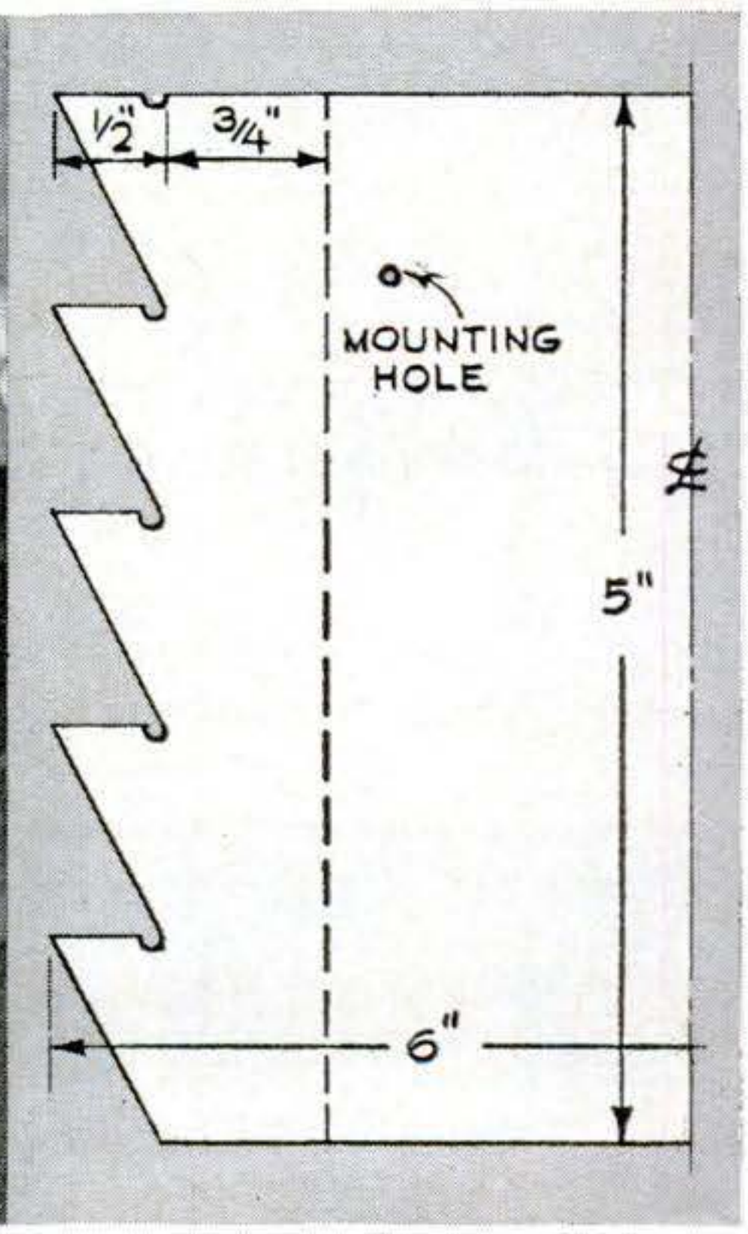
Stepped Rack Holds Squares

WHEN my squares hung from a single nail on the tool board, the one I wanted was always at the back. To rack them up separately without wasting space, I made a holder of sheet aluminum.

After making a layout (shown in drawing), I cut the notches on my jigsaw and filed them smooth. Then I bent the notched edges at right angles over a block in the vise. I used two nails to keep the rack from swinging on the tool board.—*A. R. Tanner Jr., Poughkeepsie, N. Y.*







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News about the Carter Automotive Training Program

If you qualify, you can attend a Carter School *in your area*

Trained auto mechanics are in short supply, and each year the shortage grows. That can mean steady work at good pay, because if you are a Carter School graduate you will have a thorough training in engine tune-up, fuel systems and auto electrics. Complete intensive training course includes carburetion, circuits, trouble diagnosis.

To qualify for a school in your area you should now be regularly employed in automotive service work, or in an establishment offering engine tune-up service.

Primarily, we are interested in young men who are "engine enthusiasts," who recognize the automotive service field as offering a life-time career.

● *Write us, stating your background and tell us why you want this training. You may qualify!*

Carter Carburetor, Div. of ACF Industries, Inc.
Dept. 820S • St. Louis 7, Missouri

ELECTRIC WELD - BRAZE & CUT

REPAIR MOST EVERYTHING MADE OF METAL

Home Appliances, Auto parts, Farm-garden equipment, toys. Make and repair playground equipment, lawn chairs, tables, ornamental iron work, gates, wagons, etc. Solder, heat, bend, and straighten, with terrific heat from arc torch. Cut and weld up to 1/4" steel plate. A million uses for Home, auto, farm, inventors, factories, etc. Works from any home 110 volt plug-in. Complete with dark welder's mask, arc torch, supply of carbon welding and brazing rods and complete Welding Instruction Book. Efficient—durable—1 year guarantee.

SEND ONLY $3.00 (cash, ck, mo) and pay postman $9.95 plus COD postage on arrival or send $12.95 and we will send postpaid. Ideal gift for mechanically minded home owners, relatives, friends. Order now for early delivery. Available only from:

MIDWAY WELDER Dept. DPS-12 Kearney, Nebraska

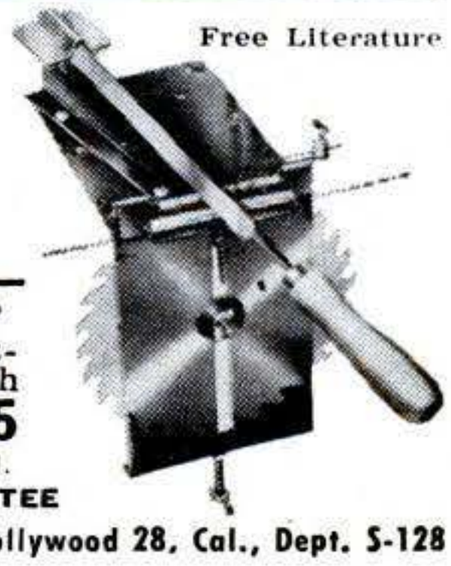
NOW! Adjustable CORNER CLAMP

AND MITERING VISE

Securely holds mitered or butt joints at 90° angle, or any angle, for nailing, stapling, gluing and splicing. ADJUSTS TO ANY ANGLE. Used for Picture frames, Screens, Storm windows, Shadow boxes, or any place where wood is joined. **$1.75 ppd.**

SAW SHARPENING IS EASY

Free Literature



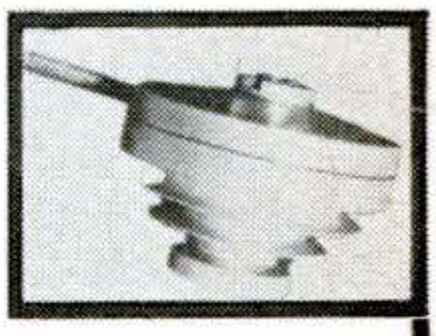
Super Filer No. 11 joints and sharpens hand and circular saws 6" to 10" with all teeth correct in height, depth, pitch, bevel. When file hits steel roller, teeth are finished. Saw runs true with no side pull. Includes 8" file. **$9.95 ppd.**

"TRU-CIRCLE" saw set automatically sets teeth at 10° or more. **$2.95 ppd.**

MONEY BACK GUARANTEE

A. D. McBURNEY, 5908 Hollywood Blvd., Hollywood 28, Cal., Dept. S-128

New "PULL-GEAR" SPEED-REDUCING PULLEY



Provides Correct Speed and Power to Drill Up to 1 3/8" with 1/2 H.P. Motor

Amazing new internally geared speed reducer doubles drill press capacity. Greater power, greater efficiency, greater productivity. Provides the correct speed and power for larger drilling, reaming, tapping and boring on light presses. Easily installed in five minutes. Adaptable to all type machines. Spindle speed range approx. 45 to 3000 RPM. Made in 3 motor shaft sizes: 1/2"—5/8"—3/4". Write for literature.

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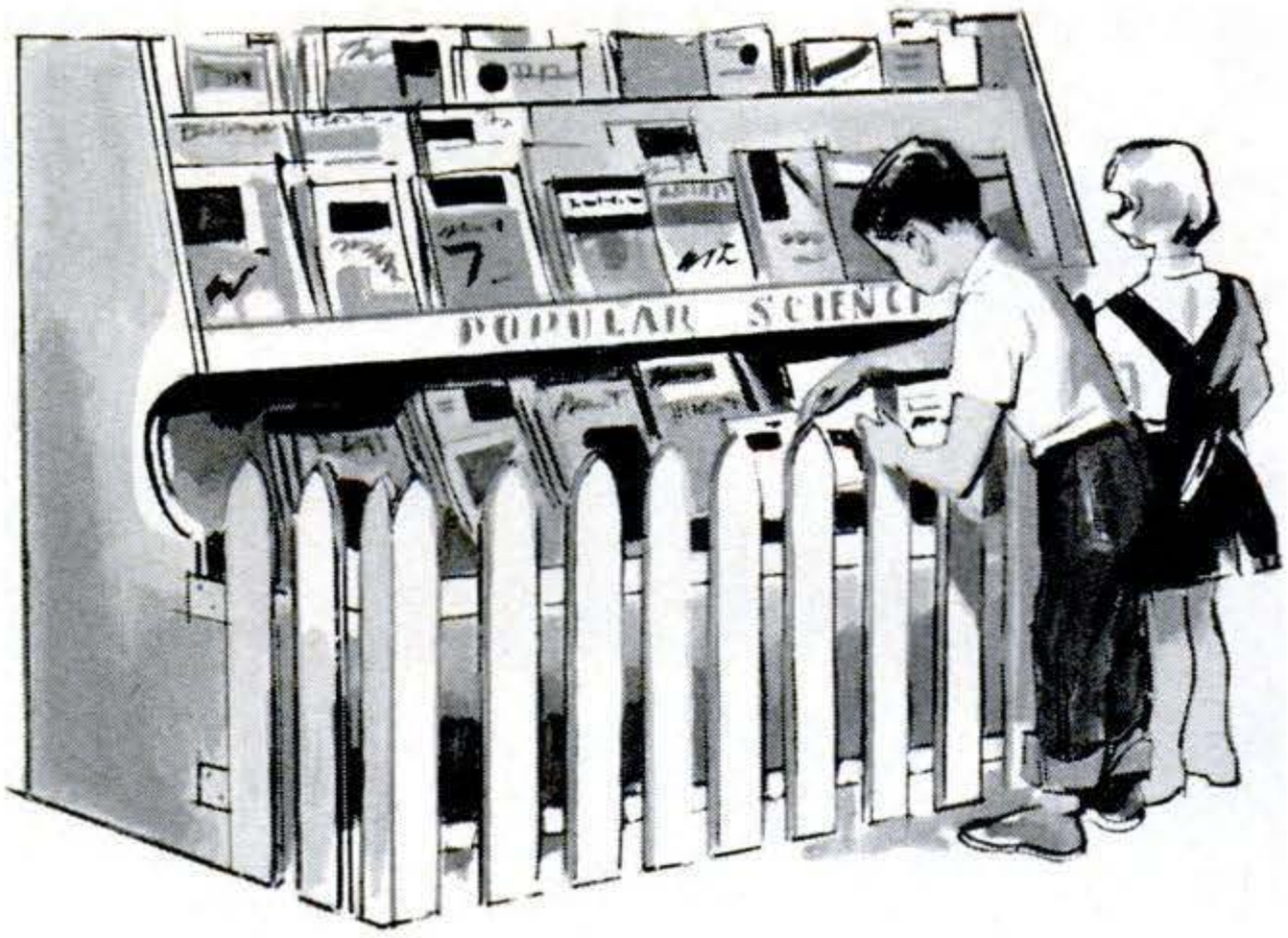
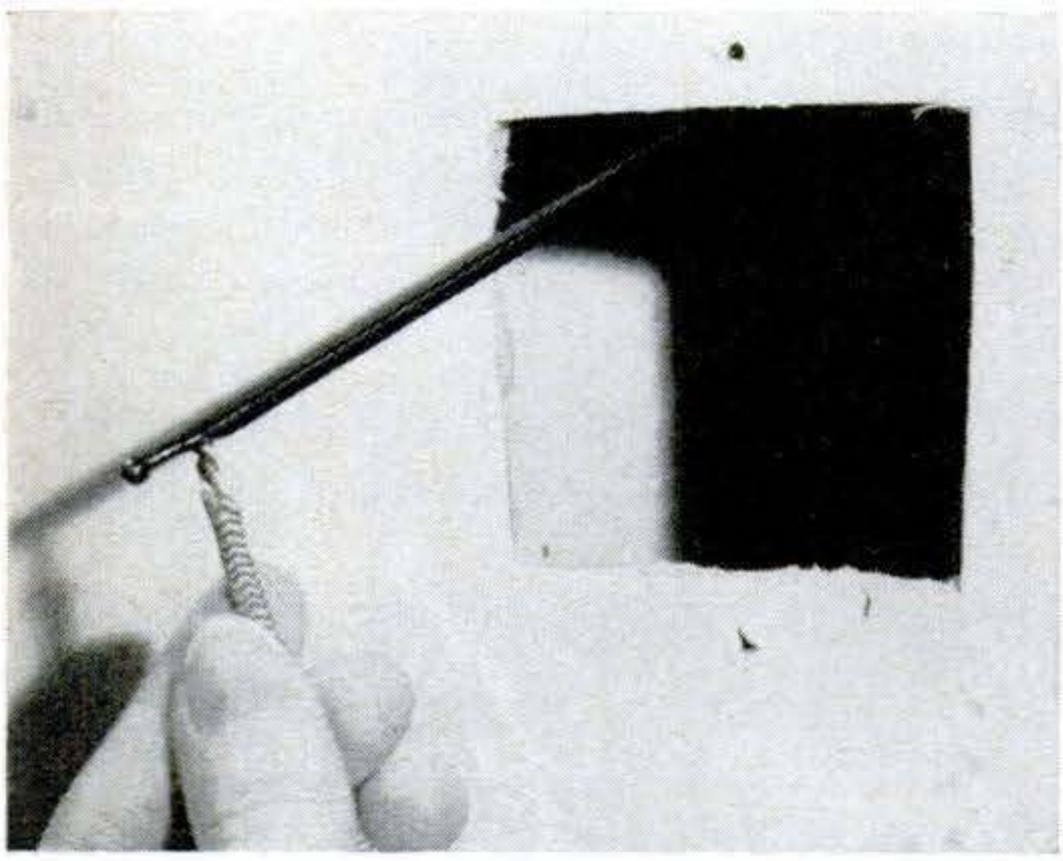
Short Cuts and Tips



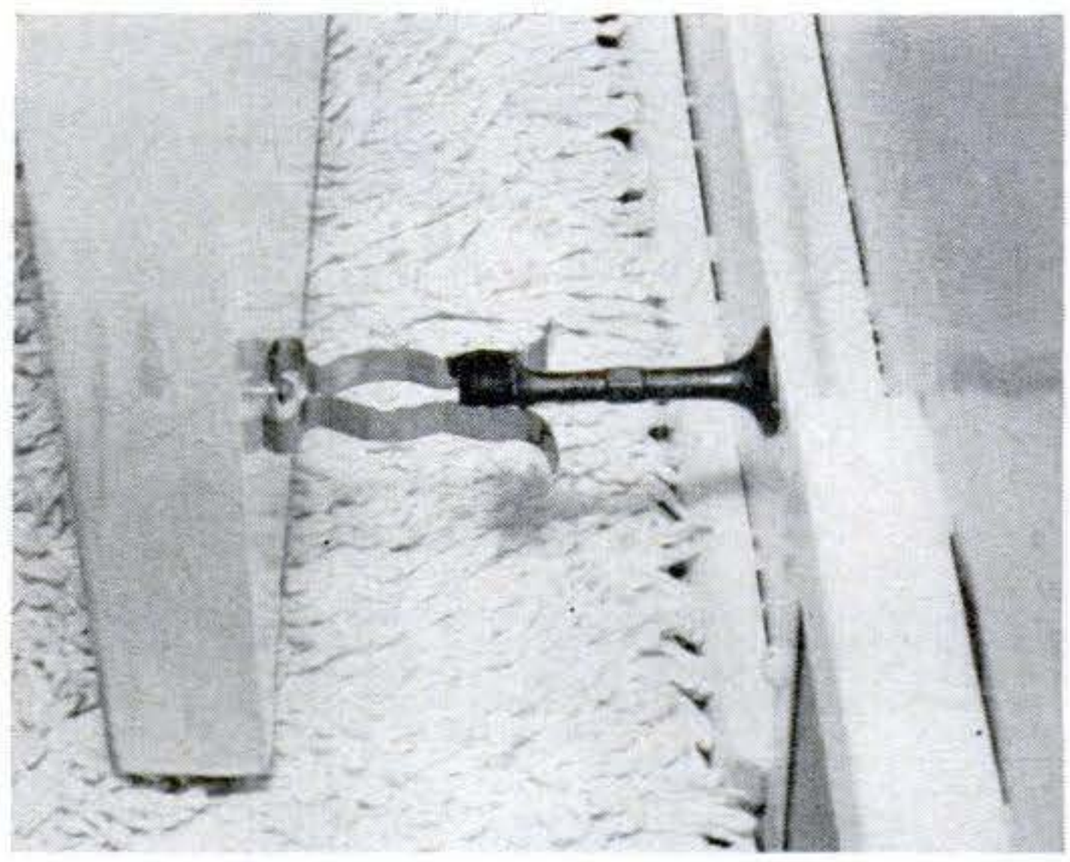
Fenced-In Display Rack Protects Magazines

ONE newsdealer keeps young hands off his magazines with a fence around his lowest display shelf. He cut pickets 24″ long, rounded the top ends, and fastened them to one-by-two rails. —*Will Stoll, Elmhurst, Ill.*



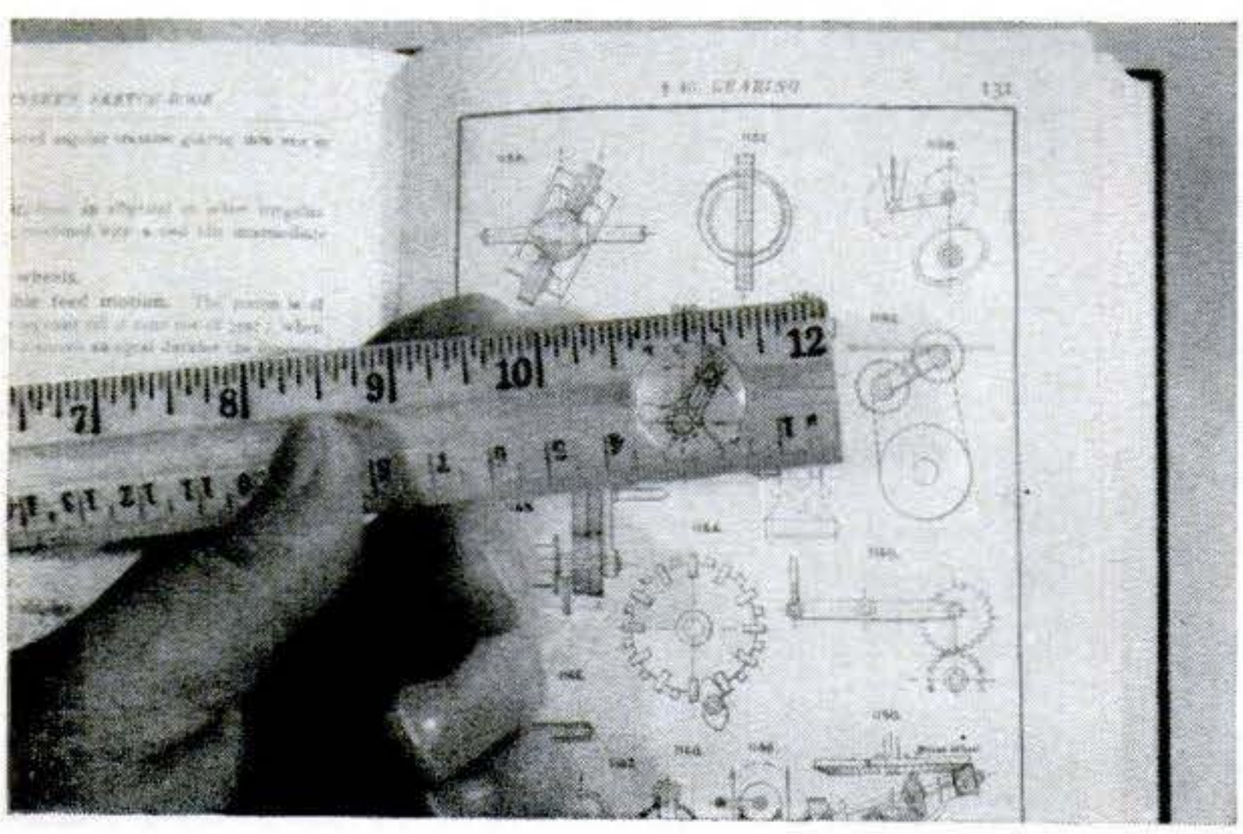
Umbrella Rib Is Wire Threader

A RIB from an old umbrella is a fine "needle" for snaking cable or other leads through walls or floors. It's good, too, for running speaker or intercom leads diagonally from one room to another on floor below. Hook the wire through the eyelet that formerly held the umbrella covering. —*Frank A. Javor, Newark, N. J.*



Clip Keeps Swinging Door Open

A SPRING clip will hold open a door that swings shut in every breeze. Screw it to the back of the door in line with the baseboard doorstop so that it grips the stop firmly. This trick works well on a swinging door leading to a pantry or a dining room, where a prop might be awkward.—*Tom Griberg, Moline, Ill.*



Ruler Carries Magnifier

YOU can get twice as much use from a shop or a desk ruler if you mount a small magnifying lens in one end. Then it will always be at hand for examining small parts and details.

To prepare the mount, grip the edges of the ruler between the jaws of a vise and, with an auger bit, bore a hole to the diameter of the lens. Bond the glass to the wood around it with cellulose cement.—*Ken Murray, Colon, Mich.*

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WAR SURPLUS AND OTHER BARGAINS SAVE UP TO 90%

$2940 NAVY AIR-COOLED POWER UNIT Most compact engine ever assembled. Portable, net wt. 150 lbs. 200 Amp. Gen. self-starter capable of delivery of double overload or continuous service at 200 Amps. Mfd. by Ranger aircraft. 2 cylinder, 4 cycle, 10 HP. 3200 RPM. Fully governed for varying loads. This unit makes one of the finest arc welders obtainable. Also makes excellent boat engine. Shipped complete with rheostat & voltage reg. All units checked & pre-tested in our shop. Complete **$185.**

Engine same as above with deluxe welding accessories as follows: rheostat, voltage reg., dry charged 24 V. battery, 50′ heavy duty welding cable, 1 electrode holder, 1 hood, pr. of gloves, voltmeter. All this only **$225.**

FAMOUS NAVY MK14 AIR COMPRESSOR Great for tree, termite, airbrush & paint spraying; filling tires, aquariums, etc. Dual & remote control electric receptacles, 115v 60 cycle AC, heavy duty HP. Westinghouse Motor. Direct drive. Water & explosion-proof. Built-in air filter, adjustable pressure setting up to 47 lbs. 3 cu. ft. per min. Self-contained switch. Mounting brackets. These units made under license of Sperry Gyroscope Co. Wt. 66 lbs. gross. Approx. GOVT. COST $585. Like NEW. **$21.95.**

With portable steel hand cart (shown), rubber wheels, specially constructed for mounting this unit. Incl. 25′ rubber air hose. 6′ extension cord with plug & fittings. Wt. 76 lbs. Complete with cart—**$26.95.**

With new internal pressure spray gun with 3 adjustable spray tips. 1 qt. cap. **$33.95** complete.

"BIG 12" ARC WELDING & BATTERY CHARGING KIT With Deluxe Accessories consisting of one R1 300 Amp Gen., 30′ welding cable, welder's adjustable helmet electrode holder, 300 AMP ammeter, 300 AMP shunt, Rheostat, Giant Toggle Switch, 300 AMP reactor coil arc Stabilizer, Voltage Reg., Reverse Current relay, 1 pr. heavy duty welder's gloves. All units guaranteed pretested. Approx. GOVT. COST $750. Most items new—all perfect. **$49.50. *400 AMP Gen. with above accessories —$64.50.**

ELECTRIC PUMP WITH CONTROL UNIT Runs on 12 or 24 V. Centrifugal type. Draws 5.2 AMPS. Has built-in removable filtering screen. Great for bilge, circulating or sump pump...bait tanks, etc. Pumps 500 GPH. Complete with on and off switch rheostat, 2 speeds (hi & lo). Mfd. by Ingersoll-Rand. Shpg. Wt. 7 lbs. Approx. GOVT. COST $195. NEW **$8.95.**

HEAVY-DUTY RHEOSTAT Ideal for regulating voltage on electric welders. Rated 5.75 Ohms, 100 Watts with double windings & dual female 25 amp., 125 V. receptacles. 7″ hi x 5¼″ D. Shpg. wt. 2½ lbs. Approx. GOVT. COST $25. Brand New. **$2.25** ppd.

"SUPER 9" 200 AMP WELDING KIT With Deluxe accessories consisting of one 200 AMP Gen., adjustable helmet, electrode holder, 30′ welding cable, rheostat, giant toggle switch, voltmeter, voltage reg., 1 pr. heavy-duty welder's gloves. All units guaranteed pre-tested. Approx. GOVT. COST $500. Most items new—all perfect. **$26.00.**

WELDING CABLE DOUBLE-O, heavy duty, neoprene jacket, fiberglas insulation. NEW. Approx. GOVT. COST $40. Will handle 400 amps. or better. 50′ lengths **$14.50.** 100′ lengths **$26.00.**

NEW! Welding Reactor for above kits. 200 Amp. cap. or better. NEW. **$7.95.**

DOUBLE-ACTION HYDRAULIC CYLINDERS — oil or air operated.

ROD END BEARING: 7¾″ length of stroke. ⅝″ shaft. 1⅛″ bore. 13″ overall. Approx. GOVT. COST $75. New. **$3.95 ea. Special—2 for $7.**

DOUBLE SPRING LOADED: Zerk lubricated end mounting. 7¾″ length of stroke, 9/16″ shaft. 1⅜″ bore, 15″ overall. Spring is removable. Approx. GOVT. COST $75. NEW. **$3.95 each. 2 for $7.**

CLEVIS MOUNTING: Stroke 16½″, Bore 2½″, Shaft dia. 1″, closed length 27″. Wt. 28 lb. Approx. GOVT. COST, $300. NEW. **$20 each. 2 for $32.50.**

WOOD PROPELLER Genuine rock maple radio drone "prop." perfect for den, trophy room, boy's room. Smooth, highly varnished, 30″ tip to tip. Clock, barometer or photo can be inserted easily into center (mounting holes provided). Can use to operate ice sleds, etc. Approx. GOVT. COST $57. NEW. **$4.95** ppd.

11 PIECE CROWFOOT WRENCH SETS Wrenches snap onto T-bar in 3 different positions. The only wrenches for hard-to-get-to places. Mfd. by Plomb Tool Co. for U.S. Armed Forces. Finest case hardened tool steel. No shop mechanic should be without this set. Approx. GOVT. COST $47. NEW. **$5.95** ppd.

REVERSIBLE REDUCTION GEAR (250-1) tremendous inertia power 6-12-24 volt winch with 2 power takeoffs! Use on boats, trucks, wreckers, etc. Fantastic power for pennies of original cost. Weight 55 lbs. Approx. GOVT. COST $475.00 NEW—**$14.95.**

NEW! 1959 CATALOG! BIGGER & BETTER THAN EVER...971 price cuts. 1000's of bargains in war surplus & other items! 100's of pictures! Send 25c in coin for your copy today!

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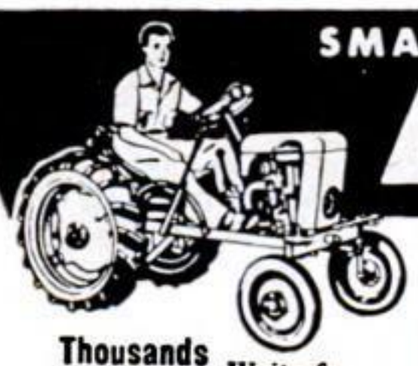

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Unequalled value! Low price!

America's finest tractor. Ruggedly built. Easy to operate. 790 lbs. Borg-Warner clutch, trans. and diff 140 to 1 reduction. 40% more drawbar pull than ordinary tractors 8-1/4 H. P. engine. 20 quick change implements. HOOD, FENDERS.

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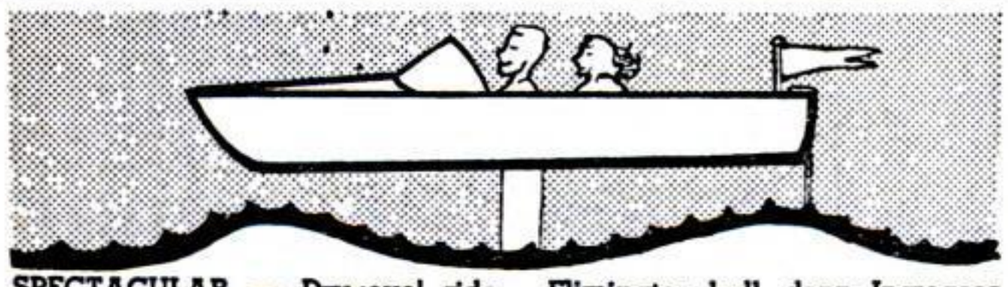

SPECTACULAR — Dry-level ride Eliminates hull drag. Increases Speed and Ski-tow power with your same boat and engine. Complete instructions on latest do-it-yourself inovation. Send $2.00 to

HYDROWEDGE P. O. Box 7503 San Diego 7, Calif.

10" TILT/ARBOR SAW
BUILD-IT-YOURSELF
from GIL-BILT KITS-PLANS

Sturdy wood, steel, and aluminum construction. NEW DEPARTURE ball bearings. Capacity and performance of floor saws selling for $150.00 and up. Plans, all metal parts in kit with 10″ comb. blade **$27.40**, less blade **$23.95**. F.O.B. St. Louis. Detail PLANS-PATTERNS only $1.00 postpaid.

Build-it-yourself 12″ and 18″ Bandsaws, 6″ Belt Sander, Shaper. Simplified plans, build easily with hand tools only. Advertised and sold for 11 years, over 33,000 units in use. Money back guarantee. FREE CATALOG.

GILLIOM POWER TOOLS, Dept. 70-M, Lambert Field St. Louis 21, Mo.

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YOUR ENGINE AT ALL SPEEDS WITH AUTO-LITE RESISTOR SPARK PLUGS WITH

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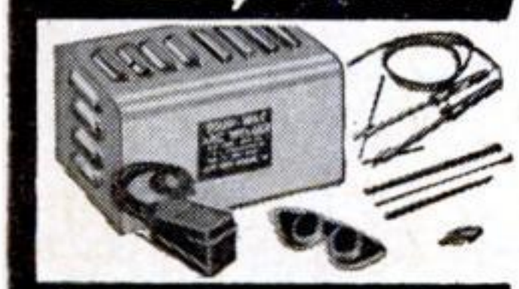
LOOK FOR THE PROTRUDING TIP!

THE CHRISTMAS GIFT FOR LIFETIME ENJOYMENT

WELD, BRAZE



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Homeowners, mechanics, farmers, hobbyists! Make repairs at home, farm or shop on fenders, bodies, bicycles, machinery—almost anything of metal. No experience needed. Welder comes complete with twin carbon arc-torch and accessories at low, low price. Operates from any properly wired 110 V. A.C. or D.C. line. Order from this ad. 10 day money back guarantee. Literature on larger equipment FREE.

FOUR-WAY WELDER CO., Dept. F3-N, 1810 S. Federal St., Chicago 16

FOUR-WAY WELDER of 1001 uses only $14.75 F.O.B. FACTORY

WELDER

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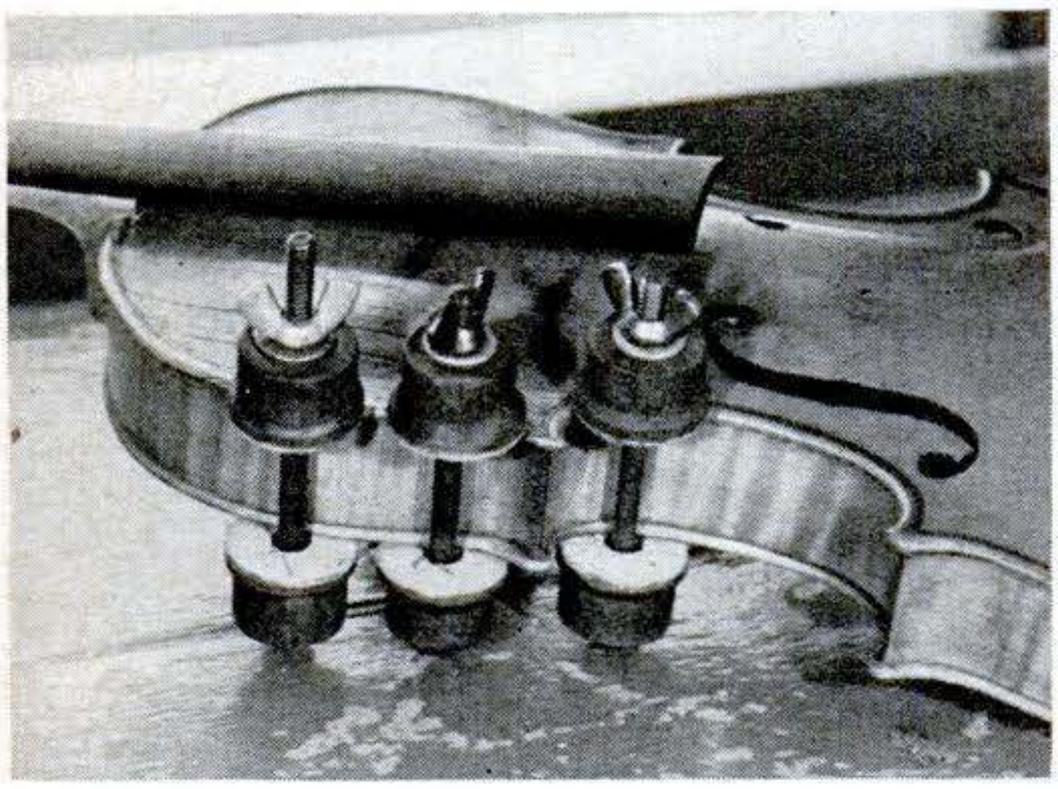
Short Cuts and Tips

Test Light Finds Hot Wire

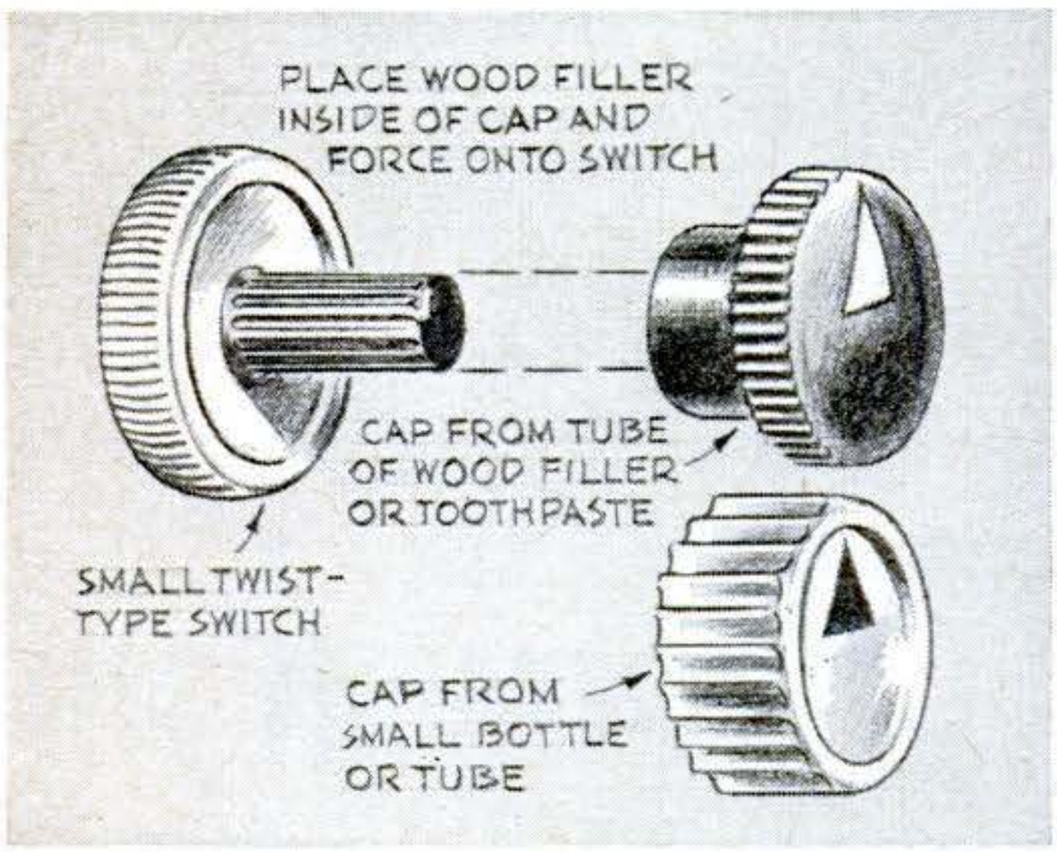
IN OLDER homes where electric wiring is not color coded, a small neon test light comes in handy for telling the hot from the neutral wire. Touch one test-light lead to one of the house wires and the other test-light lead to the metal box or cable sheath. If the neon light glows, you have the hot wire. If no glow, it's the neutral wire.—*I. R. Hicks, Centralia, Mo.*



Spools Make Cheap Clamps

EMPTY spools make light, fast-setting woodworking clamps. Saw the spools in two and stack the halves with flange facing flange. Put a washer at either end of the assembly, insert a ¼″ machine bolt and cap it with a ¼″-20 wing nut.

How wide the jaws of the clamp can be opened is limited only by the length of the bolt. For a very long stretch, use threaded ¼″ rod. I pad the clamp jaws with cork disks for delicate work like that shown.—*H. Y. Moon, Orient, N.Y.*



Cap Improves Electric Switch

A CAP from a toothpaste tube or small bottle makes it easier to grip one of those tiny twist-on electric switches. Pack the cap with wood filler, force it over the switch and wipe off any excess filler. A triangle of tape or an arrow painted on with nail enamel provides an on-off indicator.—*Frank Shore, NYC.*

Door Pocket Holds Glasses

YOU can hang a handy pocket for sunglasses right at the driver's seat of your car. Loosen the metal trim strip at the lower front corner of the window, insert the upper edge of a plastic shirt-pocket protector and retighten the strip. In winter, use the holder for the windshield scraper.—*Thomas Green, Chicago.*

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SURPLUS SALE

GOVT SURPLUS
EXCESS INVENTORY
BANKRUPT STOCK

ELECTRIC & GOLF CAR MOTOR

● Runs on 6 or 12 volt batt. Powerful gear reduction. Reversible. Cost $295. SALE **$19.72** FOB

DIAL PHONE

● Modern hi-efficiency attractive dial phone. Use for extension to main line on private system. Use several for complete private system, etc. Complete with ringer, dial, etc. Work on any system. Govt. cost $25.00. SALE.....**$9.95** Ppd.

AIR COMPRESSOR BARGAINS

For painting, cleaning, tires, control termites. Assemble your own outfit. Lowest prices in U. S.

● **DeLuxe Kit.** Compressor, tank, gauge, regulator, paint gun, relief valve, fittings, hose, instructions. Wt. 34 lbs. List $52. SALE..**$39.49** FOB

● **Air Components.** Compressor 1-cyl. **$19.95;** Air tank, **$8.79;** Regulator **$3.95;** Pop-off **$1.95;** Press. Gauge **$1.89;** Finest Paint Gun **$11.95;** Auto Switch **$4.75.** All Ppd. in U. S.

ARMY POWER PLANTS

● Marvelous buys in new condition Govt. surplus plants and generators. All FOB Lincoln.

● 1000-w, 115-v, 60-c.....**$169.72**
● 2500-w, 115-v, 60-c..... **269.00**
● 3500-w, 115/230-v **298.50**
● 3000-w, 115-v DC Generator **49.50**
● 2000-w, 115-v AC Generator **99.70**
● 5000-w, 115-v AC Gen... **291.50**

HYDRAULIC EQUIPMENT BARGAINS

Savings to 80%. Build loaders, diggers, presses, etc. All brand new.

● Blackhawk Hand Hyd. System **$23.95** FOB
● Control Valve, 1 or 2 way... **18.00** Ppd.
● Tractor Pump 1000 psi; 12 gpm ..... **45.50** Ppd.
● 12-v Motor & Pump 1000 psi. **13.95** FOB
● 2-Way Cyl. 1½" bore 6" stroke ..... **4.89** Ppd.

Other types, sizes and items. Free catalog.

STORAGE BATTERY WINCH

● Powerful fully reversible ball-bearing gear reduction winch. 1000-2000 lb. pull. Use on 6 or 12-v battery. Holds 40' of ¼" cable. For trucks, docks, boats. Wt. 54 lbs. Govt. cost $280. SALE.....**$46.75** FOB

GEAR REDUCTION POWER MULTIPLIER

● The most versatile and useful power device we have ever handled. Has tremendous torque.
● Drive with any fractional horsepower AC or DC motor. Consists of gear unit and motor mtg. base. Output speed 3 to 10 RPM depending on size motor pulley.
● Makes wonderful wagon unloader, moving belt conveyor, grain auger, dock winch, grindstone drive, etc. Wt. 42 lbs. Govt. cost of gears over $200. SALE.....**$29.79** FOB

FURNACE BLOWER & MOTOR

● Brand new, motor and blower in a single self-contained unit. Ideal for heating, ventilating and air conditioning uses.
● 115-v, 60-c motor with double inlet blower wheel. Displaces 725 cfm at 800 rpm. 7" diameter blower. 7⅞"x9¼". Overall dim. 13"x10½" x12½". Wt. 23 lbs.
List price $40.75. SALE.....**$24.95** FOB

115-V AC and 30-V DC GENERATOR

● Air Corps ball bearing unit. Puts out 115-v, 1500-w, 800 cycle, AC and 30-v, 75 amp DC.
● Makes good small welder, battery charger or will furnish 115-v for lights, stove, iron, etc. Size 6"x9"x15". Wt. 50 lbs. Full instructions. Govt. cost over $200. SALE....**$17.67** FOB

HYDRAULIC SPEED REDUCER

● Variable hydraulic speed reducer. Any speed from 0 to 750 rpm by simply throwing a lever. Handle up to 1½ h.p. Use for midget cars, shop band saws, etc. Govt. cost $400. **SPECIAL**..**$47.81** FOB

SPECIAL OF THE MONTH!

G. E. TELECHRON CLOCK SWITCH

● Marvelous automatic clock-timer switch will turn appliances, heaters, radios, TVs, air conditioners, pumps and electric signs on and off at any pre-set time.
● Clock can be set to skip any day or days of the week. For example, Sat. or Sun. or 2-day week-end.
● Finest telechron motor will run on either 110 or 220-v 60-cycle. Switch contacts will handle up to 15 amperes on either 110 or 220-volts.
Original cost $13.50. SALE.....**$4.97** Ppd.

OUTBOARD MOTORS

● Dealer's overstock brand new original cartons, leading make Scott outboards. Late 1957 and 1958 models. Full features. Factory guarantee. Limited quantity. 30% discount from Natl. Adv. List prices.
● Sizes available 3.6 hp, 5 hp, 7½ hp, 10 hp and 22 hp. Brand new, original cartons.

SPEED REDUCER

● 80-to-1 gear reduction unit. 8 roller bearings, multiple gears. Reduces standard motor to 21 rpm—increases torque. Shafts ⅜" input, 1¼" output. Power winches, revolving signs, door openings, etc. Govt. cost $66. SALE.....**$8.49** Ppd.

SURPLUS WATER HOSE

● Marvelous buy new 20-ft. lengths, 1¼" diam. (inside) with threaded pipe nipples. Stand pressure to 75 lbs. Wt. 12 lbs. List $16.50. SALE.....**$7.69** Ppd.

IRRIGATION PUMPS

● 2½", 16,500 gph. Centrifugal. All bronze ball bearing. New. 39 lbs. Govt. cost $103. SALE.....**$49.50** FOB
● Also 1½" 6000 gpm pump. Govt. cost $62.50. SALE.....**$24.61** Ppd.

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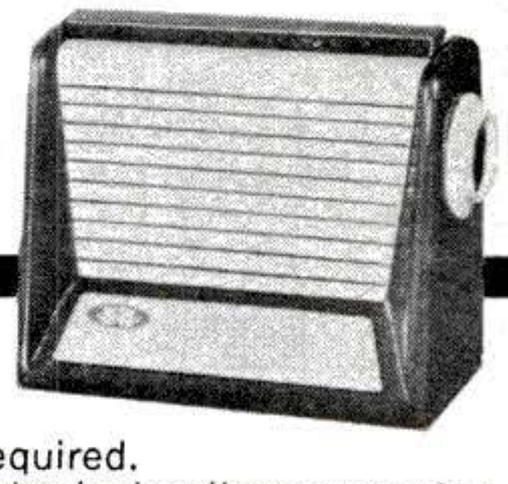

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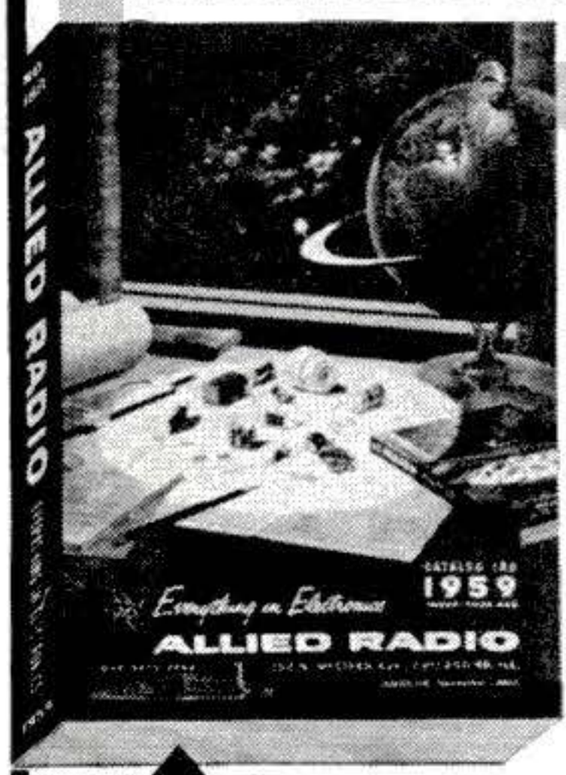

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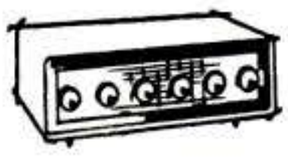

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Infrared

[*Continued from page 96*]

be broadcast directly to a giant digital computer, along with other information from ground stations; and the computer would make the final forecasts. When this happy day arrives, we'll know that if we read "Fair and continued warm today and tomorrow," and leave for a weekend at the beach, we won't run into two days of steady, cold drizzle!

Doing something about the weather is even better than predicting it. And that brings us to the next topic: outdoor radiant heating with middle infrared.

Radiant heating with electricity is pretty old, of course. The new gimmick is putting the heating wires inside silica tubes, so that the radiant energy comes mostly from the tubes, not the wires. The silica emits mostly in the middle IR, whereas the hot wires in ordinary radiant heaters give off mainly near IR and visible light. Too much of these wave lengths are reflected by white skin and light-colored clothing, and thus wasted as far as warming a person is concerned. But in the middle and far IR, different shades of skin and most clothing and other ordinary materials (except polished metals) absorb the radiant energy well.

The silica heaters have already been in use in Europe for several years. They were installed in the grandstand at the 1956 winter Olympics in Italy. And travelers in France and Germany have been surprised to come upon sidewalk cafés with people dining outdoors in the middle of winter. But only now are the units beginning to be sold in the U. S. (by Thermal-Aire, Inc., of Boston).

Among the first uses will be heating under the marquees of hotels and theaters, at toll booths, race-track grandstands, and football stadiums. Downtown shopping districts may install the heaters to melt snow and provide March weather to lure customers on bitterly cold days. Costs of radiant heating are reasonably low, because it warms people directly instead of first warming the air. And the silica heaters are fine for melting snow because snow absorbs long-wave infrared well, though it reflects visible light and near IR.

Best of all are the prospects for home use. The heating is most effective and costs least, of course, when the area is

shielded from the wind. So it may become common in the North to build low, ranch-style houses with the rooms placed around and facing in on an open court in the center. We can imagine some future Christmas season with people dining in the courtyard under the stars, or singing carols there dressed in ordinary indoor clothing, beneath a cold December sky.

These are just a few of the possibilities we can see ahead. Infrared, though discovered back in 1800, has been the most neglected part of the entire radiation spectrum, from radio waves to gamma rays. Probably not even one percent as much money has been spent on IR research as on radar research. Only during the last few years is the neglect beginning to end. So it's reasonable to expect that many new applications will be discovered, including some we can't even guess at now.

What about lie detection? What a lie detector really detects is a sign of emotional disturbance: a rise in blood pressure or a drop in the electrical resistance of the skin due to perspiration. An IR lie detector would detect a slight rise in the temperature of the cheek, a sort of invisible blush. Many people have thought of this possibility, though apparently no one has tested it yet. But there's every reason to expect it would work.

The great advantage of an IR lie detector is that the suspect wouldn't have to know he was being examined. The disadvantage would be the same as for all other lie detectors: It wouldn't work if the suspect didn't feel embarrassed at lying.

It might well be useless at political conventions when politicians make speeches promising to support the party platform. No experienced politician feels embarrassed about promising to support a platform! But reporters might find it handy to take concealed IR equipment to press conferences. There they could cleverly mix in some embarrassing questions among the innocent ones and measure what happened to the "victim's" cheek temperature.

What about a lie detector that someone sitting in his living room could point at a man's face on a TV screen? Unfortunately it doesn't look possible. Not even infrared can do that. END

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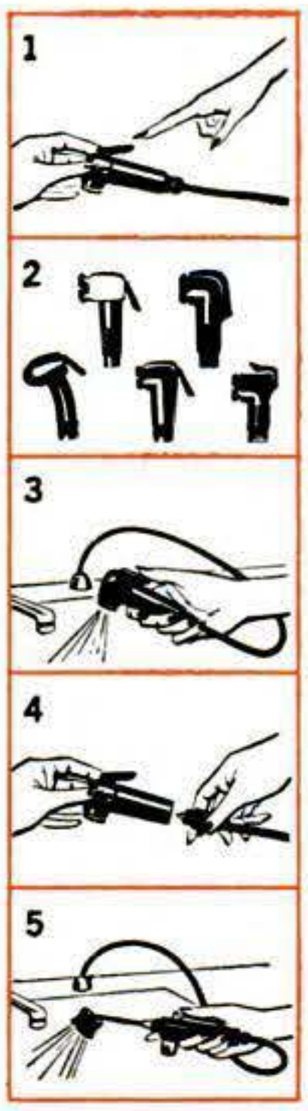

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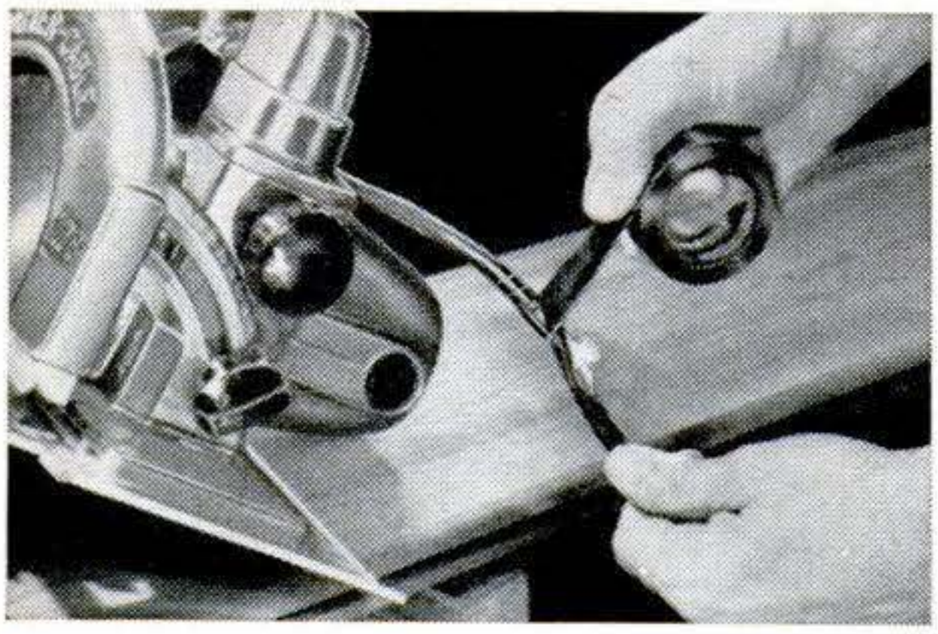

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Which Tool Should You Buy First?

[Continued from page 141]

less of which tool you are currently working with.

A portable electric drill can be a good beginning. But if a drill press is added later, you will not shelve the original purchase. There will be plenty of jobs for which the portable is better suited. Nor will that portable cut-off saw of yours gather dust when you add a table saw to your collection.

The question of accuracy. Generally speaking, more care is required to handle portable tools. You must control the tool as well as guide it. How you hold an electric drill determines whether the holes will be square to the surface.

Most times, *you* control accuracy with a portable saw. Most times, the miter gauge and rip fence on a stationary saw do the job for you.

The portables need less space. A fairly respectable assortment requires little more storage room than a vacuum cleaner, while the stationaries require space not only for themselves but also for working room *around* them.

The stationaries. The floor-bound tools offer a big advantage in speed, ease and accuracy. Using only the rip fence and miter gauge of a table saw, for example, you can turn out the parts for a dozen drawers almost as quickly as you can do *one* by the ruler-and-pencil method. And they'll all mate exactly—there is little chance of a misfit.

Consider a radial-arm saw if much of your work consists of cutting studs, rafters and joists. These operations represent a great bulk of the work you do if you're a "big-job" craftsman, and for them, you can't beat the radial arm. That's why it has always been the ideal contractor's tool. The portable saw will handle these jobs, too, besides being handy for working on the parts *after* they have been erected. But the radial arm has become popular for the home workshop because it also does fine mitering, compound mitering, dadoing, shaping, and hosts of other operations made possible through accessories. If you are going to furnish a house with good built-ins and furniture after you have the basic job done, keep this thought in mind: The radial arm makes a better all-around in-the-shop tool than a portable saw.

Or you could consider the portable saw

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first and add a table saw later. In this case, cost might be a factor. How much would a portable saw, *plus* the table saw, *plus* accessories you might need, cost? Is it less than a radial arm *plus* any accessories you might need for it? If your work isn't excessively fussy, maybe you could get by with a portable plus an accessory table, permitting you to use it as a table saw.

Why a carry-about saber saw instead of a shop jigsaw? Smaller blades and finer work are possible with the jigsaw because its blades are stretched tight between upper and lower chucks. But the currently spotlighted "saw that cuts its own starting hole" has much of the flexibility of the jigsaw and a great deal of ruggedness. Do you do more notching of studs and cutting of plumbing holes than you do pad sawing, compound-curve cutting, and fretwork? Then the saber saw you can carry in your hand is your tool.

Some stationaries are impressive because of capacity. Like the bandsaw. What portable could cut through a 6″-square timber, or resaw a two-by-six, or make eight duplicates from an eight-piece pad of ¾″ stock, and do it easily? Many a buyer's eyes have bulged at such impressive demonstrations and prompted impulse-buying without asking the question, "How often is this kind of work necessary in my shop?"

The monarch tools. These exclusives do jobs that other tools can't. Like the lathe. Maybe it's not talked about too much because its uses are specific, but it's just as much a king. Happy the man who makes bowls, trays, lamp bases; there's no choosing problem for him. The lathe is the only tool that does the job.

In the same area are the sanders—portable, that is. No matter what tools you've got or how many, whether you bring the job to the tools or the tools to the job, an abrasive hand is always needed.

The most important point about buying power tools is to get those tools first that you will use most in the kind of work you want to do. In the long run, you will be happier with a thoughtful selection based on your own needs than you will be with a random collection of the latest fads bought on impulse. Still, the lucky man is the one who can afford not to make a decision—he buys them all, portable and stationary. END

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Man's First Leap Toward Free Flight

[Continued from page 73]

in the sudden silence, plummeted hard to earth. He was shaken up, not badly.

"I'll never do that again," he told me. "The first lesson you have to learn is to keep thrust on even if it threatens to drive you too high. It's the thrust that lets you down easy. And the characteristics of the propulsion unit are such that you are let down smoothly even when it's running out."

Sturdily, he tried it again. Again he crouched, hit the button, and jumped. Upward he arced, higher and higher. Like a chip balanced on a fountain of exhaust gas, he rose for a long instant, and then dropped gently into clouds of dust and flying twigs. Firmly on his feet when he landed, he could have fired a burp gun or dived for a foxhole.

In the final "hot" version, each of the five canisters lasts for "several" seconds. They can be burned separately or, if a soldier is in real trouble, all at once. If burned in sequence, the total thrust duration is "about one minute." The model is built with off-the-shelf hardware; its propellants do not explode if dropped or punctured. New canisters can be snapped in place of exhausted ones in less than a minute. The thrust can be tailored to suit any size man.

The curtain of security closes in here. The exact time of completion of "hot" testing by Burdett's group and its demonstration for Army brass cannot be disclosed.

Listening to Burdett and his engineers, you get the feeling that the possibilities are boundless. Militarily, the jump belt gives a soldier the agility of a kangaroo. A GI could leap across rivers, skitter across bogs, dash up slopes or even bluffs.

Since the jump belt is not inherently expensive—and the skill called for no greater than that of many other athletic endeavors—there are civilian uses to think about, too. Burdett foresees firemen racing into burning buildings, cops chasing running gunmen, mountain rescue teams reaching stranded victims. Hunters could chase wounded deer, skiers could ride back uphill, explorers could avoid dangerous crevasses.

Listening to the little group of engineers who built this strange new gadget, you feel that the sky is the limit. END

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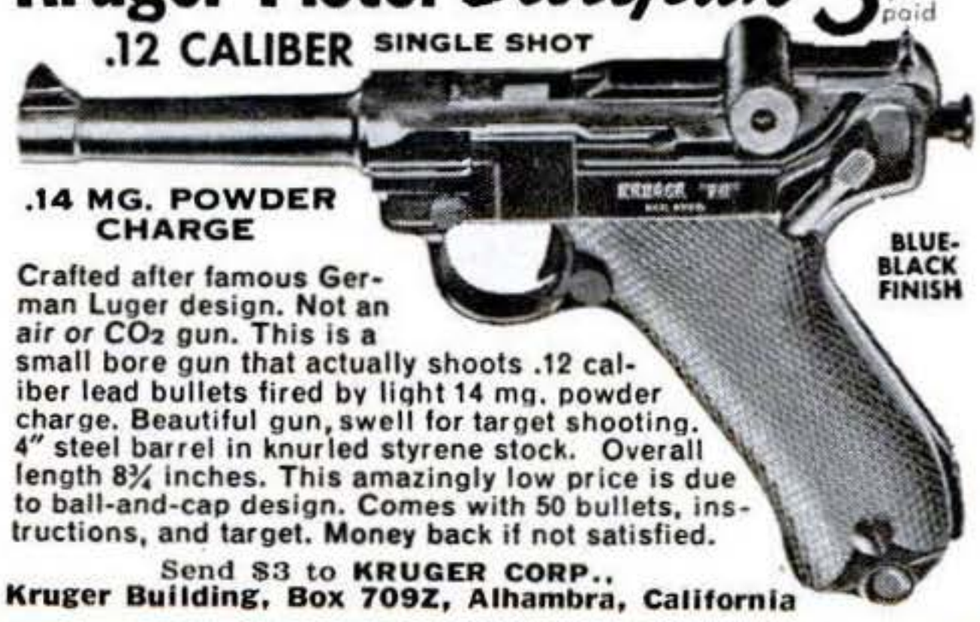

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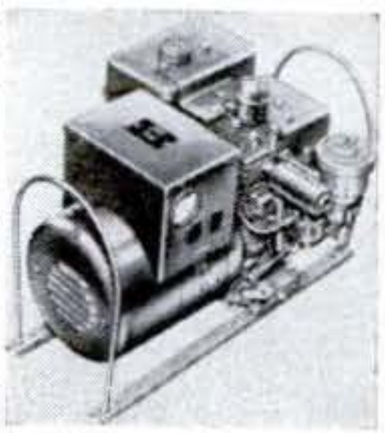

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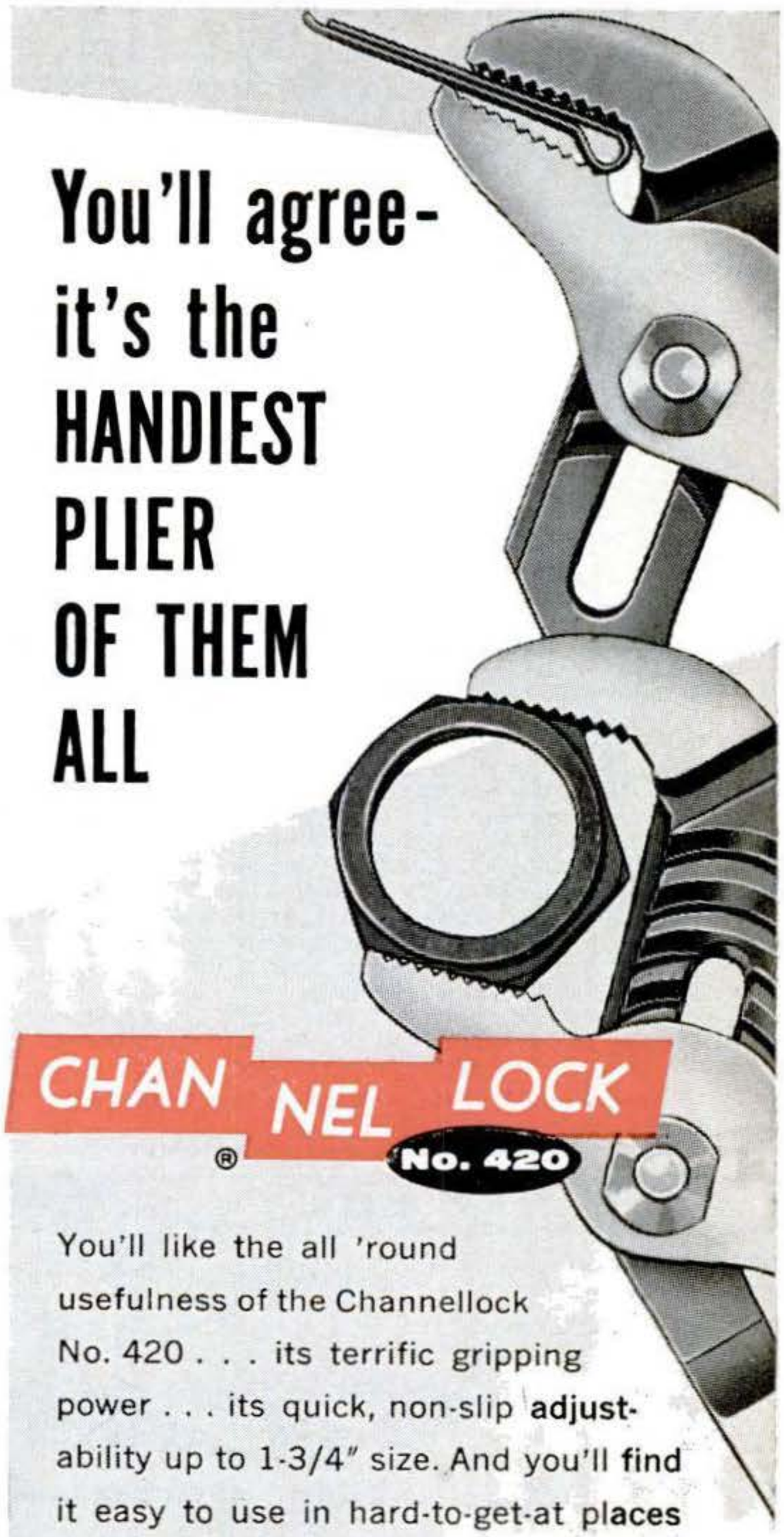

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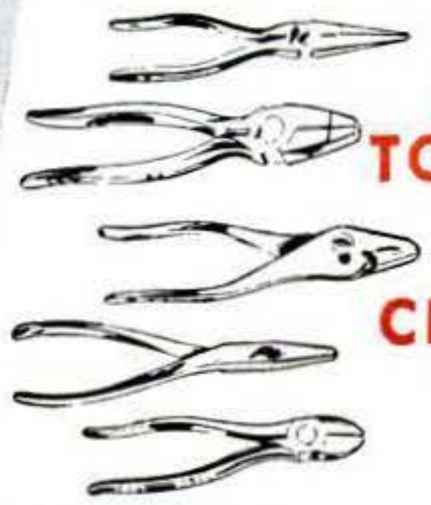

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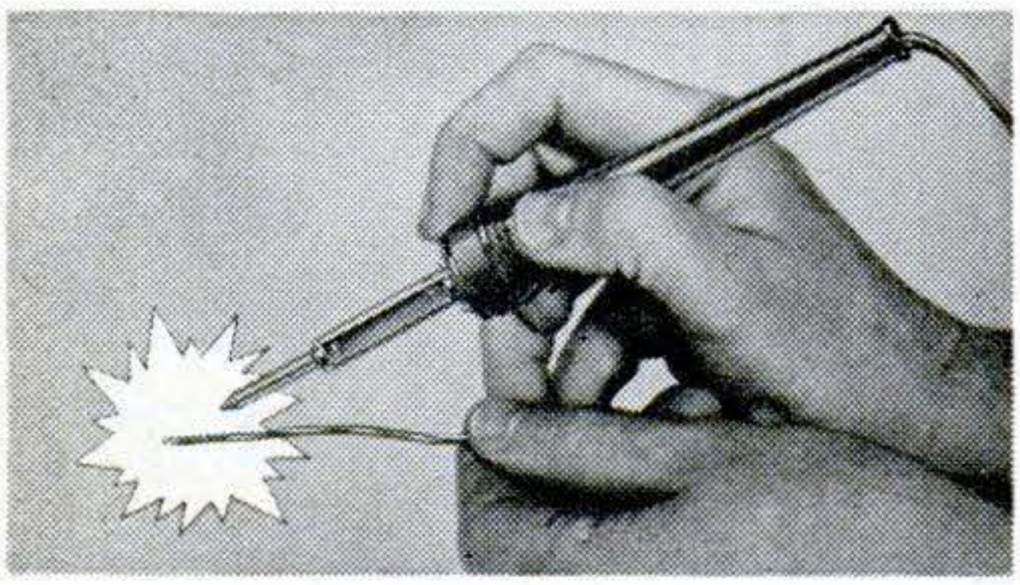

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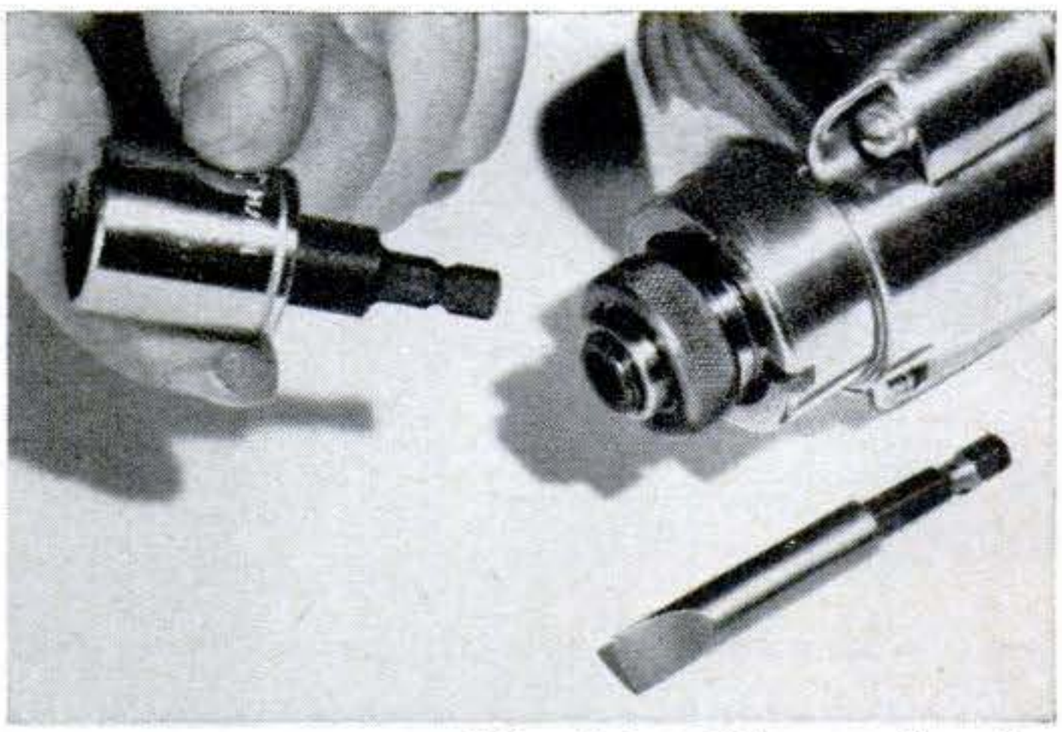
All About Buying Electric Drills

[*Continued from page 146*]

Gears. Unloaded, most ¼-inch drill motors whirl at speeds up around 20,000 to 30,000 r.p.m. This is much too fast for most jobs. So high speed is traded for high torque at a lower speed by using reduction gears. Generally two or more stages of reduction are better (and more expensive). The better the material used for gears and the more carefully they are machined, the more efficient the power transfer and the longer they'll last. Here's another place your money can buy better quality.

Bearings. A big chunk of the motor's power gets used up overcoming friction in the gears and bearings. In a typical drill (one gear-reduction stage and sleeve bearings) over half of the power at rated current will be lost in friction.



LOW-SPEED DRIVERS like this Millers Falls take nut sockets and screwdriver bits as well as drill chucks. Low speed of 275 r.p.m. provides easy handling without extra speed reducer.

Better bearings can make a big difference in the amount of useful power you'll get from a given motor. One manufacturer puts it this way: "The addition of ball bearings to the armature and gear shafts can increase the efficiency of the tool from 40 percent to 50 or 60, depending on how many bearings are used and their quality."

The chart bears him out. Here the figures are for maximum power output, and the case for ball bearings seems even more clear-cut. For example: The two Millers Falls drills seem to be practically identical except for the bearings used. The one with sleeve bearings consumes 480 watts of electricity to produce the mechanical equivalent of 140 watts at the

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chuck. (One horsepower equals 746 watts.) The same drill with ball bearings requires only 460 watts to produce 185 watts output.

The chuck. While chucks look alike (they're now almost all of the gear type), some are truer than others.

You can make a pretty fair test of chuck quality with a piece of chalk. Insert a new twist drill, steady your hand, and start it running. Then carefully bring the chalk against the drill shank about an inch in front of the jaws. The chalk should ride evenly around the metal. If it doesn't, you should be able to see or feel any irregularity. An out-of-round chuck gets worse as you use it.

Industrial vs. domestic ratings. The big difference between these two ratings is in the way Underwriters Laboratories tests drills for the two classifications. The important point is that nameplate current ratings on drills approved for industrial use turn out to be more conservative and meaningful. You can rely more on them in choosing between drills: A higher current rating usually does mean a higher-powered, heavier-duty motor.

Nameplate differences between domestic drills may also reflect real differences in quality, but you just can't be sure.

Convenience. Most of today's ¼-inch drills are lighter and shorter than those of a few years ago. A lighter drill is obviously easier to wield, especially when you're working overhead or in an awkward position; a shorter one can get into more places. The drill "offset"—the distance between the top of the body and the centerline of the chuck—may also be important when you have to work in tight corners.

One-hand operation isn't always desirable. For some heavier types of work, you may want an auxiliary side handle so you can put your weight behind the drill and take a firm, two-hand grip.

A lot of designing has gone into handles and body shapes. The best way to judge the feel and balance of a drill is to heft it a few times. While you're at it, check the feel of the switch. They're practically all of the momentary trigger type, but you'll find slight differences in the location and operation of the locking pin. Try several; you may find that one kind fits your hand better than another. END

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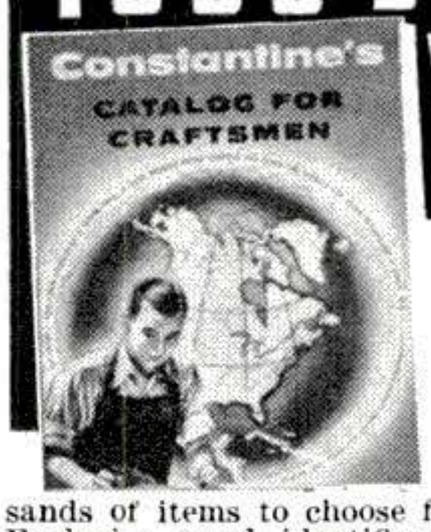

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Why We Smoke So Much

[Continued from page 90]

That's just a theory. However, scientists have turned up evidence that some smokers do in fact differ from other people. For example, when tobacco extracts were injected into the skin of a number of smokers, 16 percent of them showed an allergic reaction, and ailments that might be attributable to smoking occurred four times more commonly in this group than in the smokers having no reaction.

Again, in healthy young adults—Johns Hopkins medical students—whose fathers or mothers had had high blood pressure, smoking tended to bring on unusually large changes in heart activity. (The heart's response to exercise differed, too.) Where a parent had had coronary heart disease, the changes were smaller than usual. Further, the students considered most likely—for hereditary and other reasons—to get diseases of the heart and blood vessels at some future time were also those most likely to be smokers.

There's evidence of correlation between smoking habits and personality traits. Investigators emphasize that this does *not* mean that smoking affects personality. It does suggest that those who have the cigarette habit may also be more likely than other people to have particular traits.

Among 250 Harvard graduates—chosen for study, while they were still in school, because they were judged to be entirely normal—the heaviest smokers tended to be restless, to be seekers after danger, to have had trouble in marriage. Non-smokers tended to be steady and dependable and to have had stable marriages. Other differences:

- When examined in college, the smokers breathed faster, tended to have lighter reflexes—and drank more coffee.
- The non-smokers tended to enter scientific careers; the smokers, careers in social relations, education and writing.
- Since leaving college, smokers have continued to drink more coffee. They also drink more alcohol.

The speculations that researchers are making today have historical precedents. Centuries ago, Europeans took up smoking in part because of its supposed medicinal value. And Jean Nicot, the Frenchman who gave his name to the drug, earnestly believed that tobacco cured many diseases—including cancer. END

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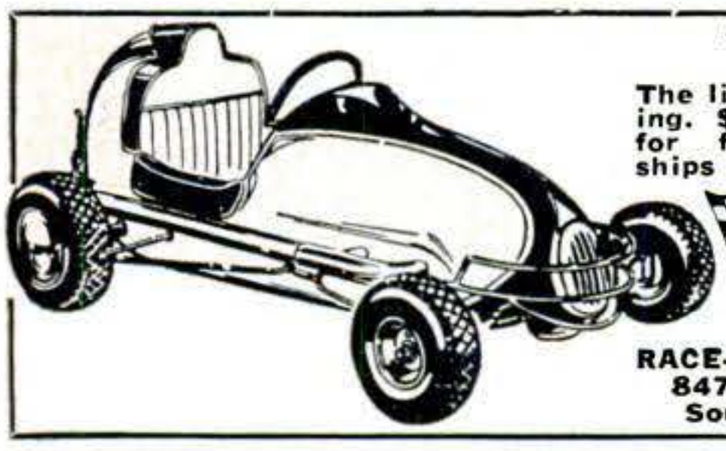

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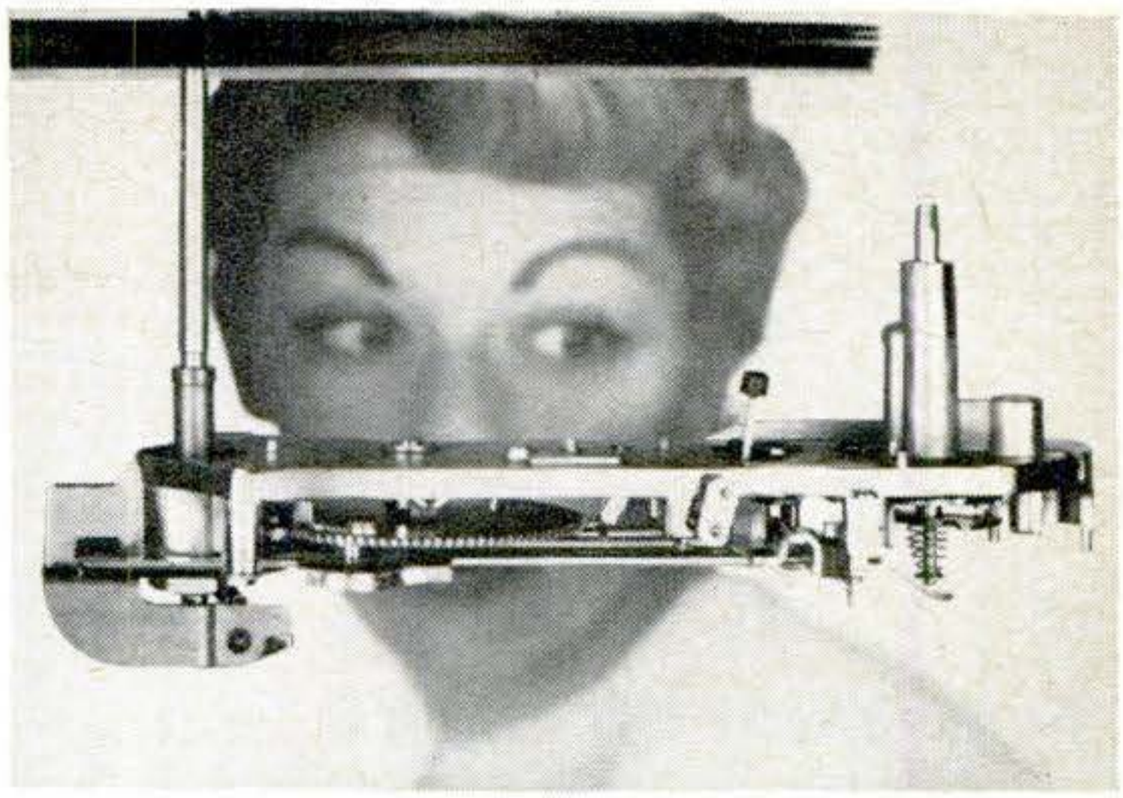

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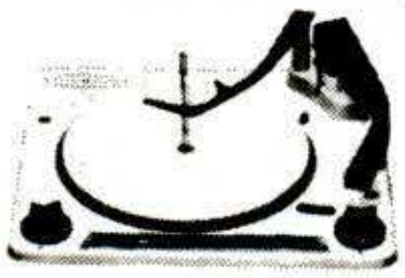

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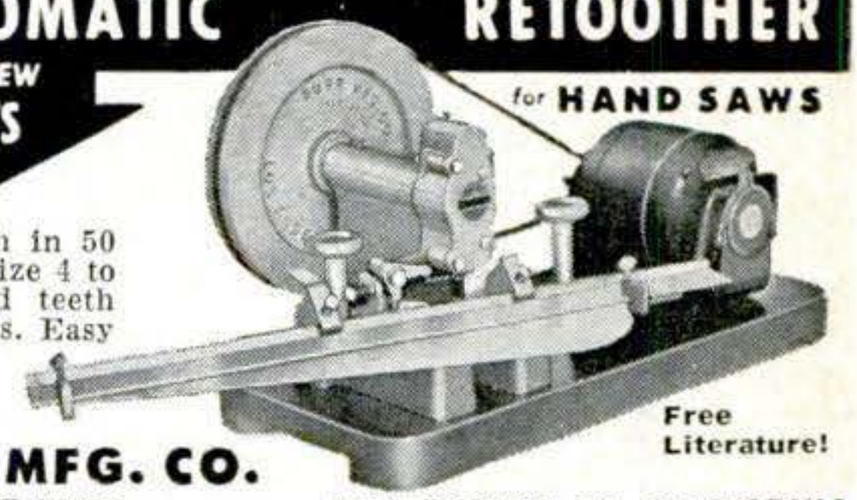

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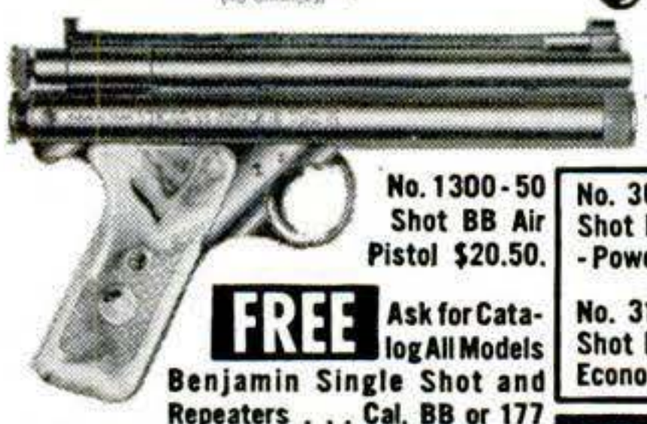

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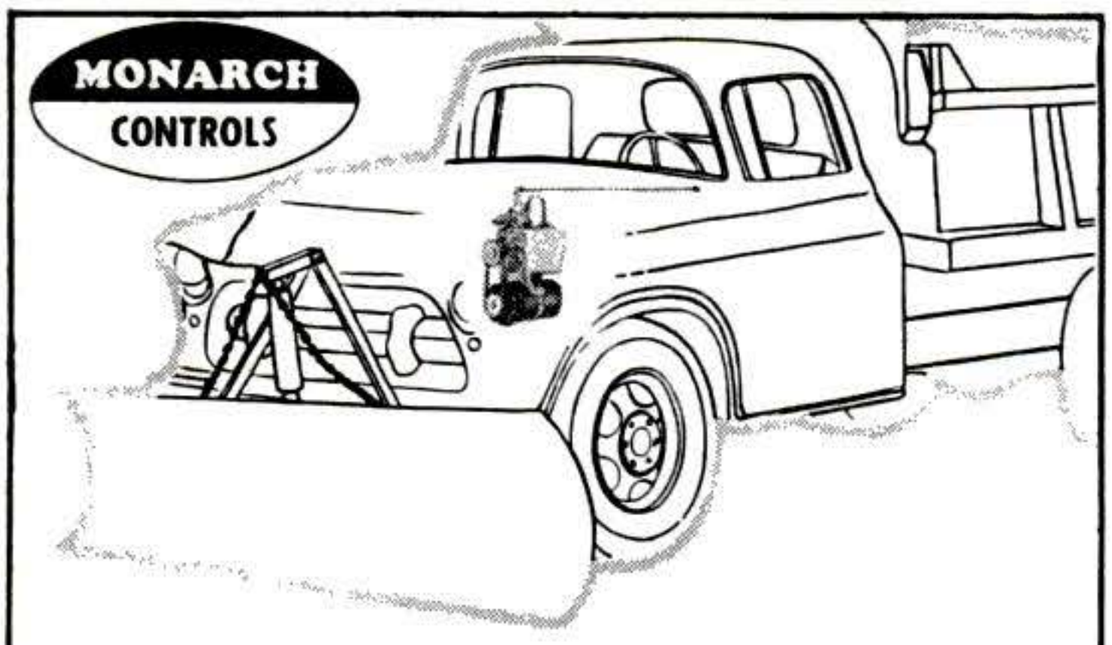

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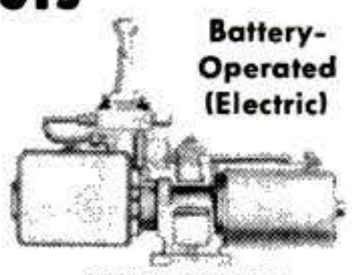

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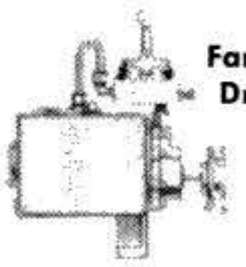

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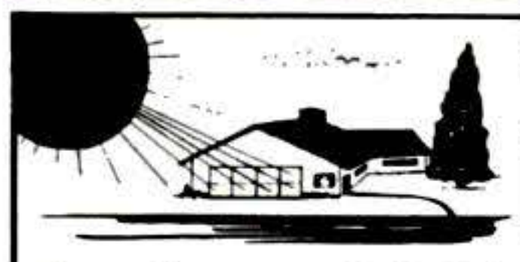

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6 Ways to Sharpen Your Memory

[*Continued from page 115*]

had to go over it 68 times to master it. But when he took another list of equal size and spread the work over three days, he made it in only 38 repetitions. What's more, he retained the second list better—forgot it more slowly later on.

Ebbinghaus also discovered that there are good and bad times for mass-memorizing. You memorize fastest when you're most alert. Ebbinghaus himself was a late-morning man. You may be different.

Remembering numbers

Rarely should you bother remembering long lists of numbers—tables, formulas, prices, telephone numbers. When you need them, look them up.

But you may need some figures so often that they're worth memorizing, just to save time. Anyway, there's no harm in a little showmanship. If you can calmly call off a number that's used often around your shop but that nobody else knows by heart, you'll give your boss one more reason for taking notice of you.

Ebbinghaus' method works on numbers. Or you can link numbers with the sounds of letters. In one popular system each of the digits is assigned a consonant sound, thus:

1 . . . d, t, or th
2 . . . n or kn (silent k)
3 . . . m
4 . . . r
5 . . . l
6 . . . j, soft g, sh, or ch
7 . . . k, hard c, hard g, or ng
8 . . . f or v
9 . . . p or b
0 . . . z, s, or soft c

To remember a number, substitute a consonant sound for each digit, then put in vowel sounds to form words—the more ridiculous or shocking, the better.

Suppose you want to remember that there are 28.3495 grams to the ounce. You might translate the number as "No fee, my Ruby Lee," or "Knife me, rabble!" In either phrase, the consonant sequence is: *n, f, m, r, b, l.*

You end up with a colorful image instead of a set of abstract digits. "For the majority of people," says Dr. Furst, "words and pictures are easier to remember than numbers." END

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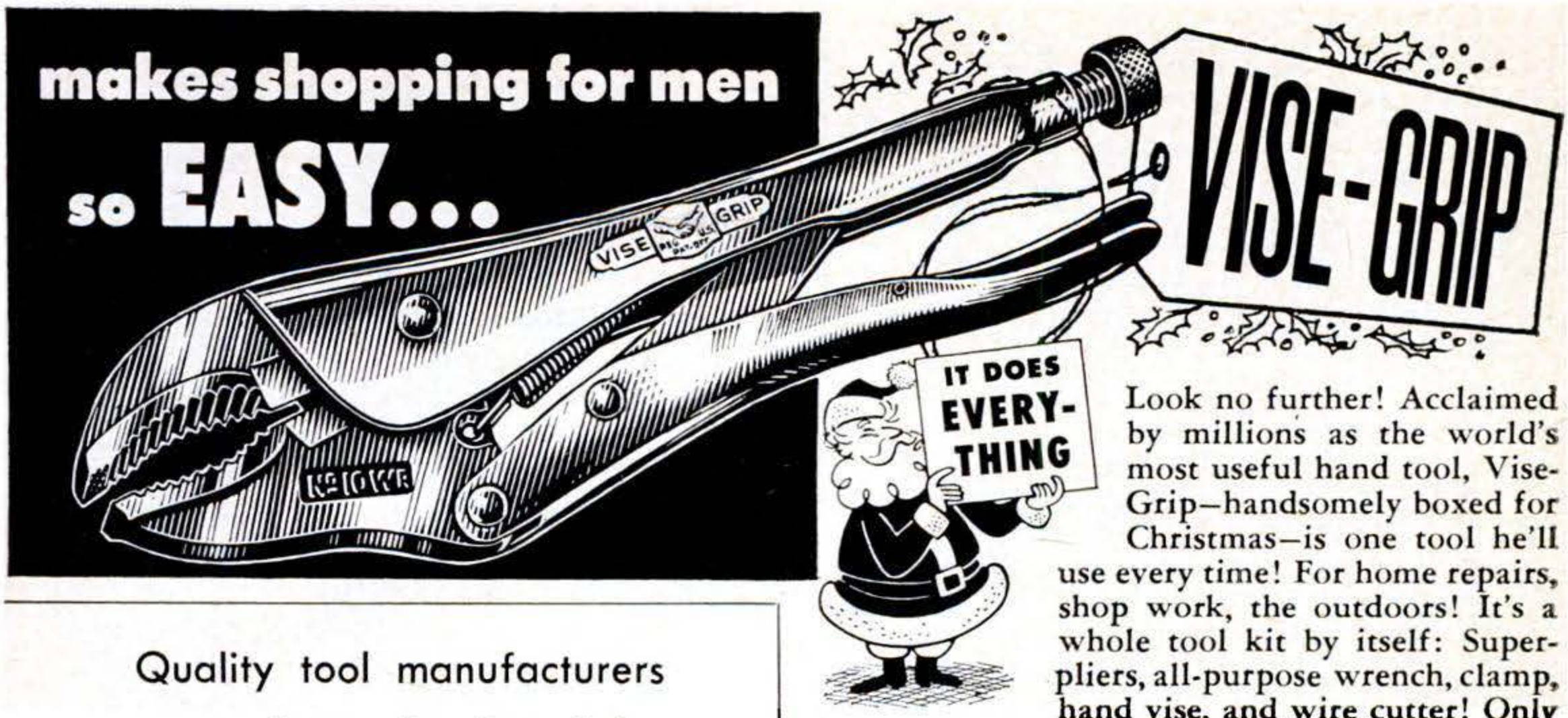

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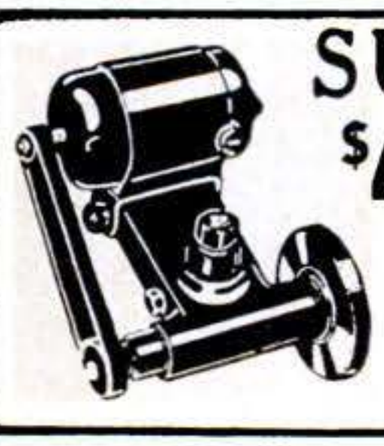

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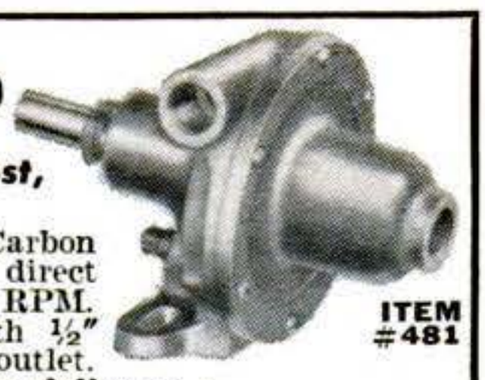

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Driver's Report: Lark Vs. Rambler

[Continued from page 69]

get none of that brake, brake! who's-got-the-brake? feeling in a panic stop. The Rambler's panel generates an exciting sense of opening a Christmas package. The Lark's, purely functional, again resembles something from abroad.

The miles-per-gallon performance of both cars, with both engine options, are about where they should be considering power outputs, weights, and axle ratios. In overdrive, the Lark six registers from 33.9 miles to the gallon at a steady 30 miles an hour to 25.7 at 60 m.p.h.; the Rambler six from 30.8 to 21.2. For the V-8s: the Lark, 27.5 to 20.5; the Rambler, 24.2 to 18.

The Rambler six performed under the handicap of only 90-odd miles on the odometer. The other cars had been broken in. (For a detailed report on gas economy, see the chart.)

Acceleration figures tended to support a suspicion that Studebaker's engineers have taken their torque at the low end by valve and spark timing. With a 3.73 axle, the Lark six reached an indicated 60 miles an hour from zero in 20.4 seconds and accelerated from 40 to 60 in 10.6 seconds. The figures for the Rambler six with a 4.1 axle: 16.3 and 8.7 seconds.

The Lark V-8's best 0-60 time with the 3.73 axle was 9.2 seconds, and 40-60, 6.1 seconds. The Rambler V-8's times with the 4.1 axle: 13.5 and 6.5.

As for ride, anyone who quarrels with the feel of either car on the road ought to admit emotional maladjustment.

How the Lark came to be is the story of a change of posture by Studebaker-Packard with respect to its products as they compete with those of American Motors, the other independent producer, and of the three big corporations, Chrysler, Ford and GM.

The Studebaker Champion, produced for 20 years, is gone. So are the other familiar lines, or series—the Commander, the President and most of the Hawk sports-type cars. The Studebaker Scotsman, a true austerity automobile, lasted only a little more than a year. The company killed off the Packard, except for the name, in 1957. Besides the Lark, only the Silver Hawk remains on the production line.

The Lark was first sketched out in Au-

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gust, 1956. Active blueprint work was started two years ago last fall.

"We wanted to give the U. S. motorist what to date the industry has not supplied," says Harold Eugene Churchill, Studebaker's iron-gray president and one of the few auto manufacturers to come up through the engineering ranks. "That was a smaller, full-size car to transport passengers at minimum cost consistent with maximum comfort and safety."

First goal was economy. Under Eugene Hardig, the company's chief engineer, Studie's 20-year-old flathead-six engine was torn apart for a fresh look. Hardig wanted a smaller, "stiffer" engine. So a new crankshaft was designed, with more overlap between the four bearings. The stroke was shortened from 4.375 inches to an even four. The bore was left at three inches. Cubage was cut from 185 to 170 inches, and horsepower from 101 to 90. Torque went down from 152 pounds-feet at 1,800 r.p.m. to 145 at 2,000. The compression ratio went up from 7.5:1 to 8.3.

The V-8 engine, producing 180 horsepower with a two-barrel pot and 195 with four barrels and dual exhausts, was pretty near what Harold Churchill wanted. It was left alone except for a redesign of the intake manifold for better fuel economy and a boost in the compression ratio from 8.3 to 8.8.

Working from the ladder-type Champion frame, the engineers retained its width, shortened it and added stiffeners. The gauge of the frame metal for the V-8 was increased. What the engineers know as "torsional rigidity" (resistance to twisting) shot up 24 percent, and "beam rigidity" (that to fore-and-aft bending) 23 percent.

A series of foreign cars, meantime, began to cruise Studebaker's three-mile test track. Churchill, Hardig and Mike DeBlumenthal, Hardig's assistant, wanted to find out what the imports had that they could use. One result of that was the design of a box section for the front of the car, made from a single metal stamping. This also was part of the stiffening process.

While Duncan McRae, the company's chief stylist, went to work on appearance under an injunction from Churchill to keep it simple, work was started on the

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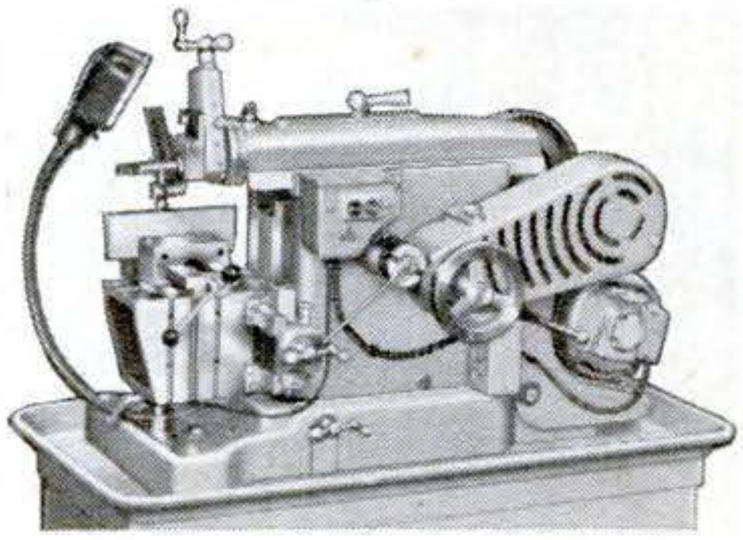

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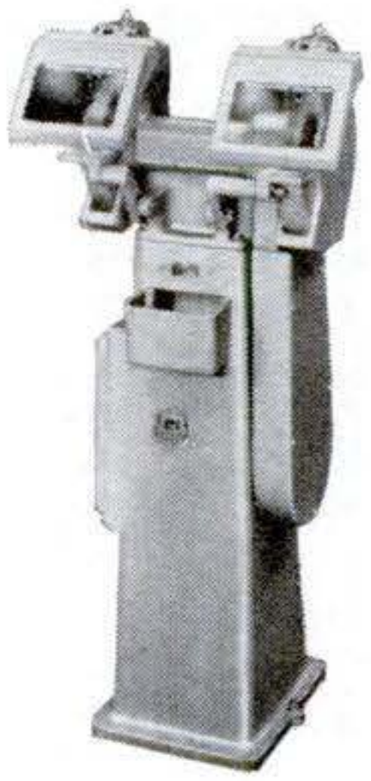

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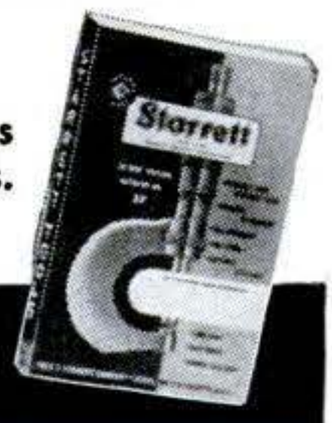

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springing. This was tricky because the Lark—known then only as Car X—was to be several hundred pounds lighter than anything Studebaker had ever built. Yet it had to have a feel of weight and stability if it was to appeal to motorists who would want to heavy-foot the gas pedal on cross-country trips.

A hand-built Car X was driven at varying speeds over the roughest roads on the proving ground without shock absorbers. The object was to mate the front and rear spring "rates" (the amount of deflection under load) and "frequencies" (the number of cycles per minute under shock).

"We made it on our second try," reports DeBlumenthal, looking as though he had just seen a miracle.

Overhangs, naturally, were razored down. Compared with the Champion's 35.6 inches in front, that of Car X was fixed at 27 inches. The rear overhang was reduced from 50.3 inches to 39.5.

An immediate result of the surgery in front, in which the engine was moved back, was a reduction in the steering effort. Compared to the Champion, it requires 22 percent less pulling on the wheel to park the Lark with a V-8 and 12 percent less with a six.

The Champion's brakes were adopted without change. On the Lark six, there is a square inch of brake area for each 17.5 pounds of car, and on the V-8—which comes with bigger brakes—one for every 17.1 pounds. Those figures better the ones for the Rambler, or for Chevrolet, Ford or Plymouth.

Once off the ground, the Car X project moved fast. Sometimes, in a jam, the engineers worked around the clock. The bulk of the chores were completed during 1957. In a small company, changes don't have to await the approval of a 50-man evaluation committee.

"Want to see what we've done to the manifolding on the 259-inch?" Hardig would telephone Churchill.

"Yup," would be Churchill's reply. He was there in five minutes.

Studebaker has high hopes for the Lark. It's pleased with some initial returns from outlying precincts—the banks and finance companies are anxious to do business on a car so priced that the chance of repossessions from installment buyers is considerably reduced. END

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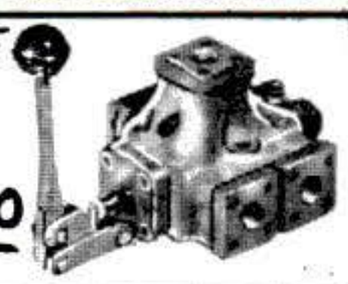

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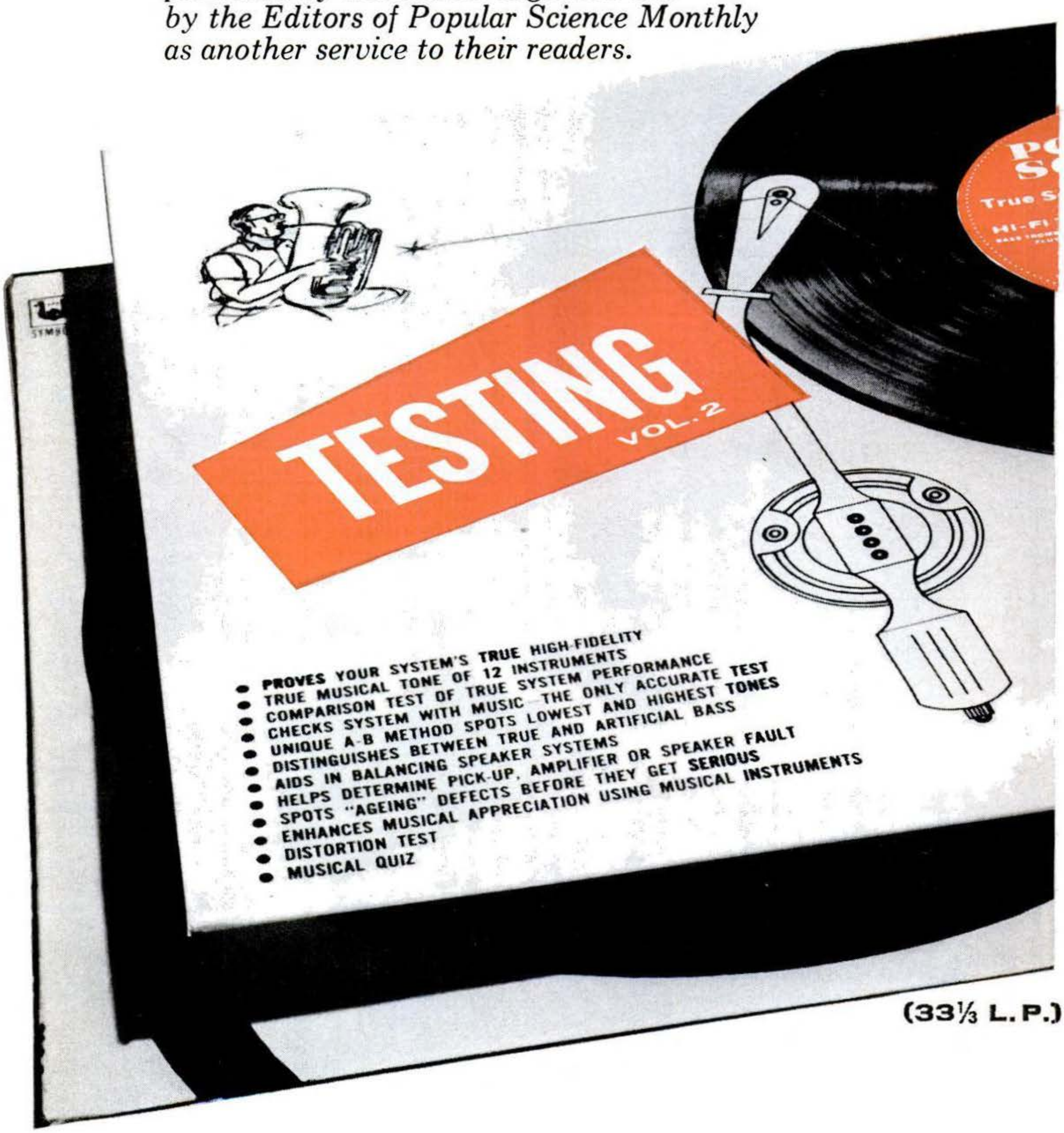

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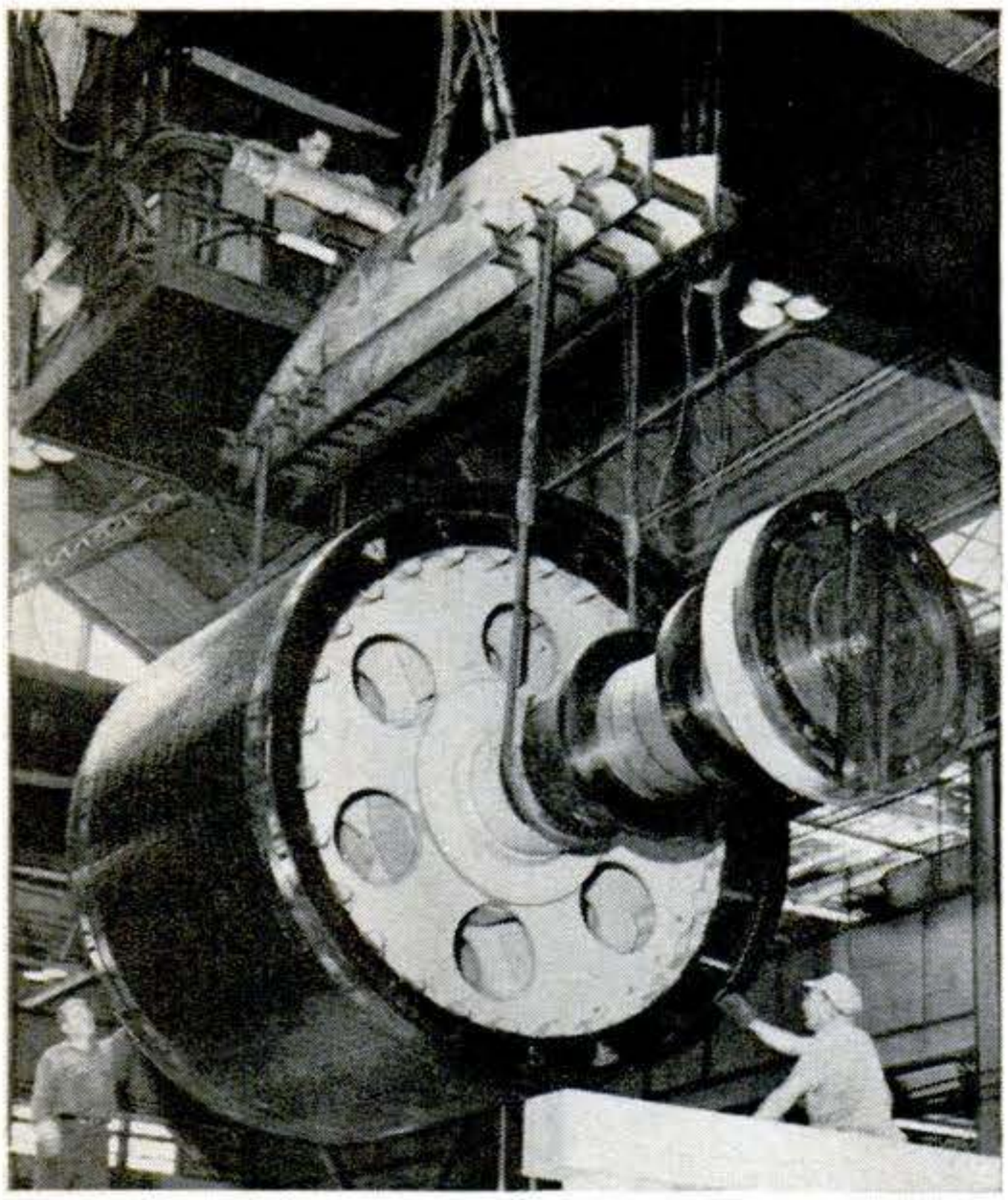
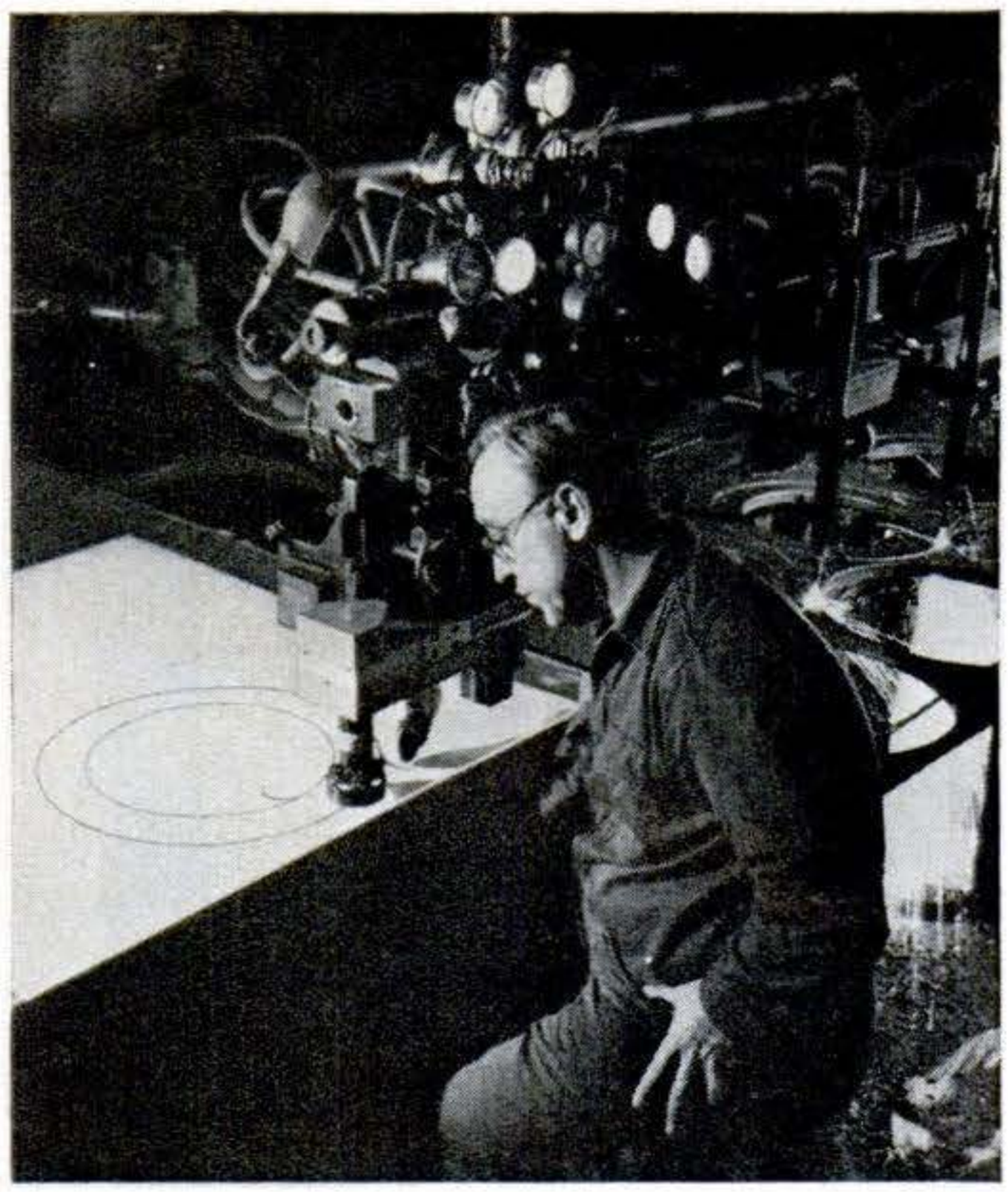


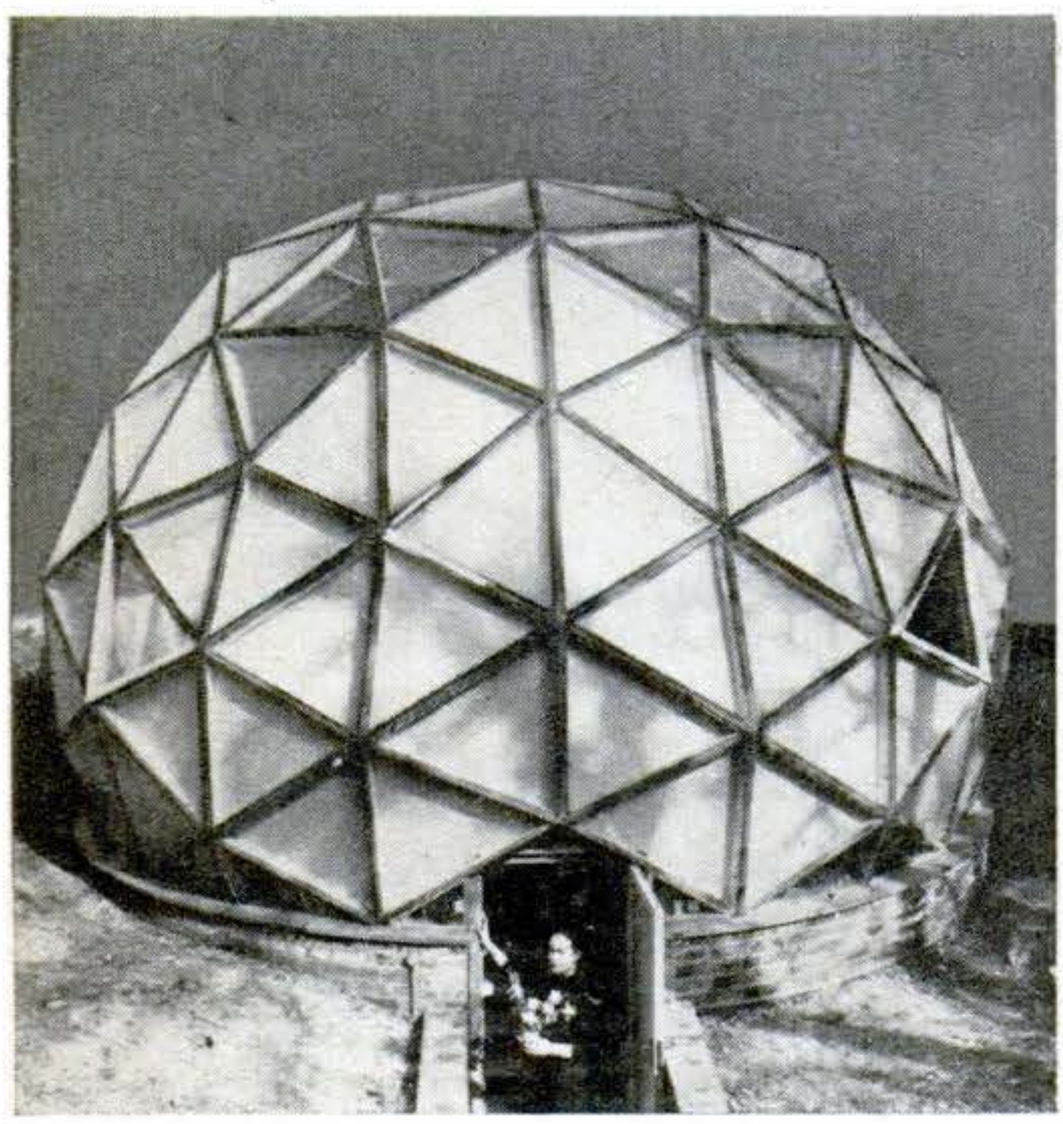
Automation in a big way

THIS giant 98,700-pound rotor is nine feet in diameter. It was made by General Electric for a rolling-mill motor at a steel plant in Monterrey—the first in Mexico to be put into automatic operation.



Electric eye operates cutters

HERE an electronic tracer is being put through its paces at Westinghouse to direct a battery of cutting torches through an intricate design. It uses a vibrating photo-sensitive cell to trace the pattern.



Studio topped with glass dome

THE odd building above is made of 150 triangles of glass set in light wooden frames. It was built as a back-yard studio in two days by Hugh Pope, British cathedral architect, his wife and a friend. Behind the glass is a lining of panels that can be taken out or put in to increase or diminish light from the sun.

Biggest beams support roof

WELDED plate girders 365 feet long and weighing 125 tons each—the largest ever produced in the United States—form the roof of this double-cantilever hangar. It is being built at San Francisco's International Airport for United Air Lines and has sufficient breadth in its 153,000 square feet to service big jet airliners.

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HOW TO KEEP ROLLING WHERE OTHERS CAN'T

GETTING where you are going over icy roads and other treacherous surfaces is all a matter of taking simple precautions and some easy-to-learn driving know-how.

First of all, proper gas pedal, brake pedal and steering wheel handling will prevent mishaps. The rule is, *make no sudden moves!* Drive as if you were balancing a full glass of water on your dashboard. That means slow down, turn and accelerate gently . . . *g-e-n-t-l-y.* Try not to come to a complete stop—especially on an upgrade—you may have difficulty starting again.

What's more, even if you use tire chains or snow tires all winter, carry a dozen or so small paper bags filled with sand. They'll start you moving when nothing else will. Just throw sand under each rear wheel and *go.*

How to Safe-T check your engine against winter

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1. *Safe-T checks against freezing,* down to the temperature level you select.
2. *Safe-T checks against evaporation.*
3. *Safe-T checks against corrosion.*
4. *Safe-T checks against rust.*
5. *Safe-T checks against boil-away,* even on warm days.
6. *Safe-T checks against foaming.*
7. *Safe-T checks against hose rot.*
8. *Safe-T checks against deposits.*

Texaco PT is the only anti-freeze with a nationwide guarantee of protection—honored under the Texaco star in all 48 states. It's the finest anti-freeze you can buy!

TEXACO DEALERS IN ALL 48 STATES

Texaco Products are also distributed in Canada, Latin America, and Africa

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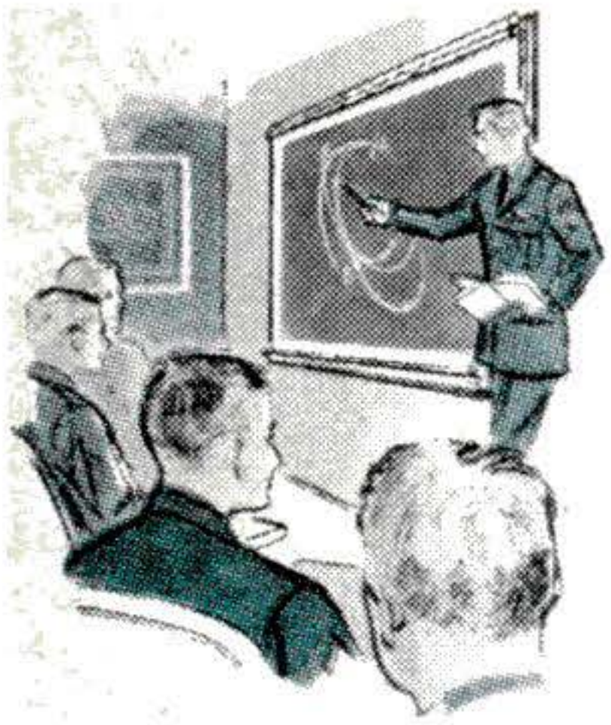
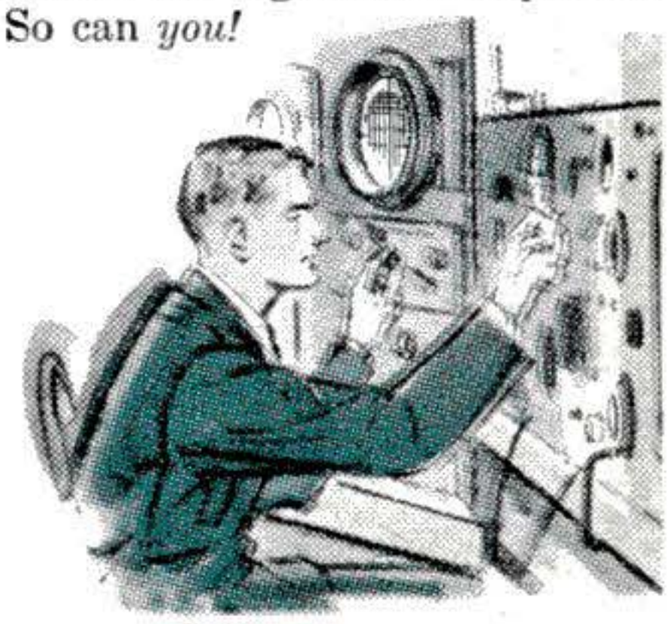
Prepare yourself for a better future...

Choose the education you need in Today's Army

Here are three important ways in which Today's Army can help you further your education . . .



1. LEARN THROUGH SCHOOLING: If you're now in high school—by all means *stay in school!* But if for some reason you've had to leave school, here's how Today's Army can help you qualify for a high school diploma or college credits. The United States Armed Forces Institute (USAFI) can offer you more than 150 top-notch academic and technical courses. And there are even opportunities for regular classroom instruction right on your post. You can earn credits in courses you need to get your high school diploma—drawing a regular salary while you're learning! Thousands of Army personnel have qualified for high school diplomas and begun college level studies through USAFI. So can *you!*



2. LEARN BY DOING: Only in Today's Army can you choose your spot—and have it guaranteed*—*before* you enlist. For example: Interested in guided missiles? Sign up for the Army Air Defense Command! This will guarantee you an assignment to on-the-job training with a guided missile unit defending an important metropolitan area. You can even choose the metropolitan area in which you want to serve. Pick the spot that gives you priceless training and experience in the work you like most. Your assignment is guaranteed *before* you enlist!

3. LEARN THROUGH TRAVEL: Travel is the most exciting way in which Today's Army helps you round out your education. You meet new people, learn different customs, see the things you've read about come to life! And in Today's Army you can choose your travel—it's guaranteed* *before* you enlist! Europe or the Far East, you *know* where you're going because you chose it yourself. You can even enlist and serve with your buddies, sharing the wonders of the world together in an outfit you're proud of. Learn through travel—*choose* your travel—*before* you enlist. This week, get details from your Army recruiter.

* **HERE'S HOW** *your choice is guaranteed before you enlist: Just tell your Army recruiter which outfit you want to join—or where you'd like to serve. He'll check to make sure there's a spot open in the outfit or area you want. If there is, you get it. If not, there's no obligation.*

Plan your education—get CHOICE, not chance, in Today's Army

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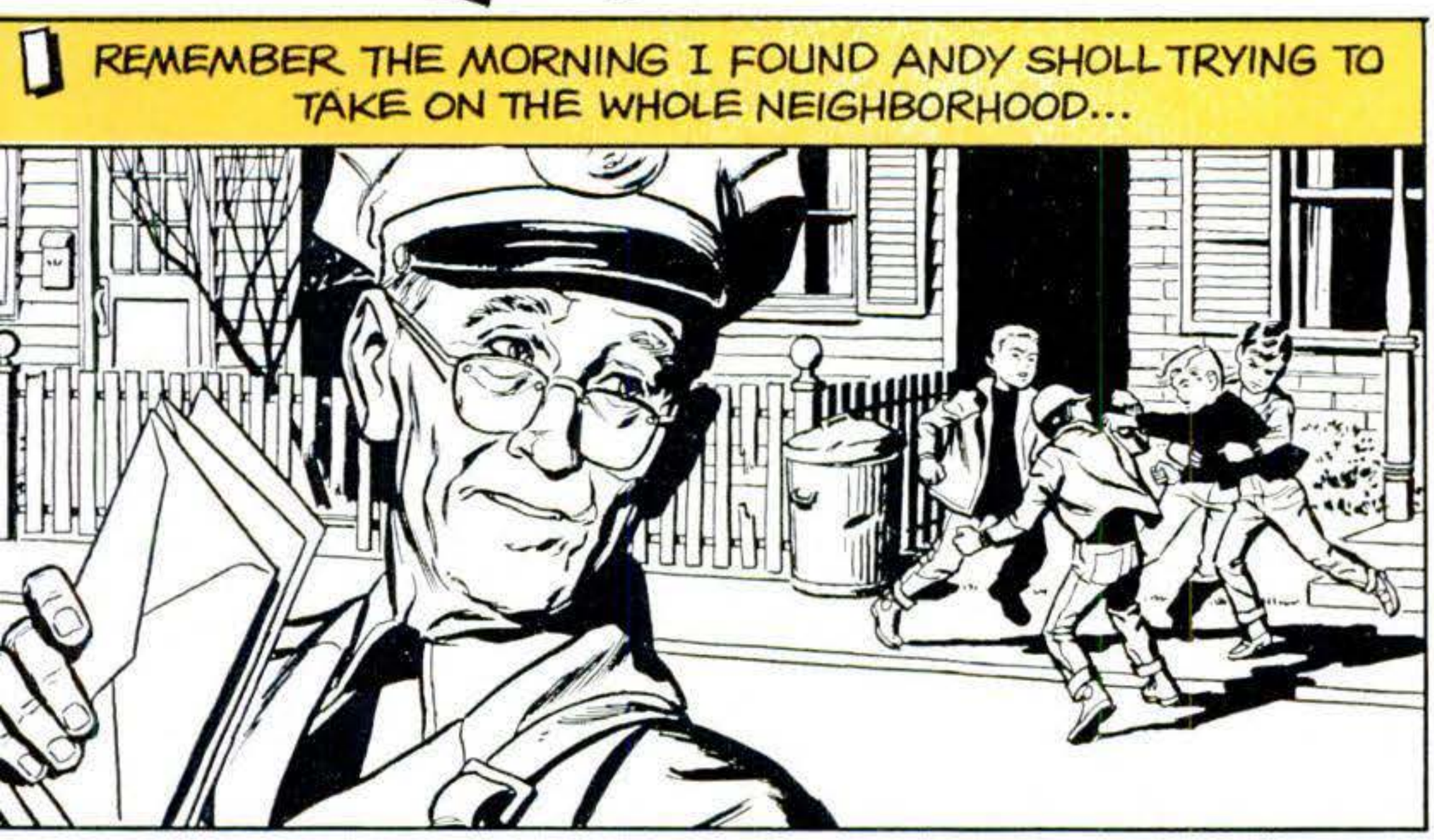
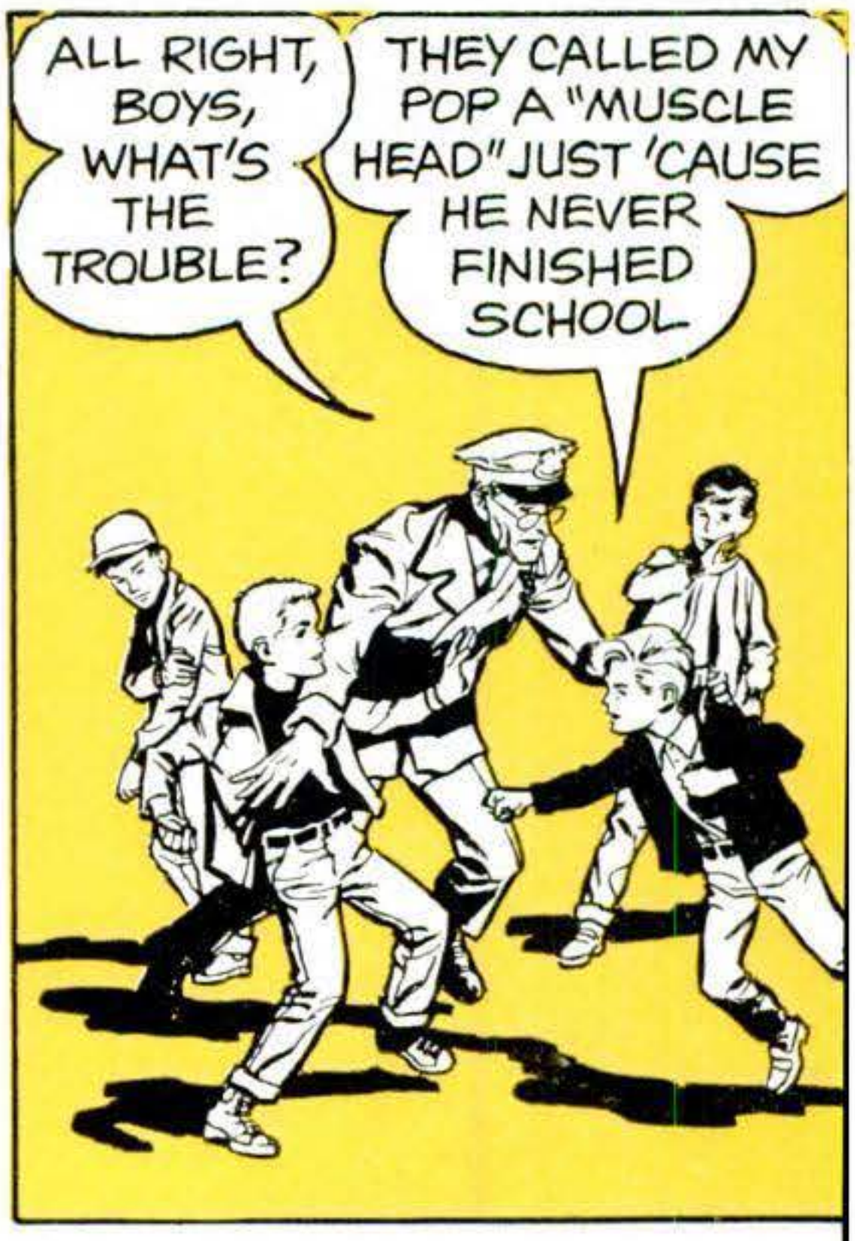
THE MAILMAN


I REMEMBER THE MORNING I FOUND ANDY SHOLL TRYING TO TAKE ON THE WHOLE NEIGHBORHOOD...


ALL RIGHT, BOYS, WHAT'S THE TROUBLE?
THEY CALLED MY POP A "MUSCLE HEAD" JUST 'CAUSE HE NEVER FINISHED SCHOOL

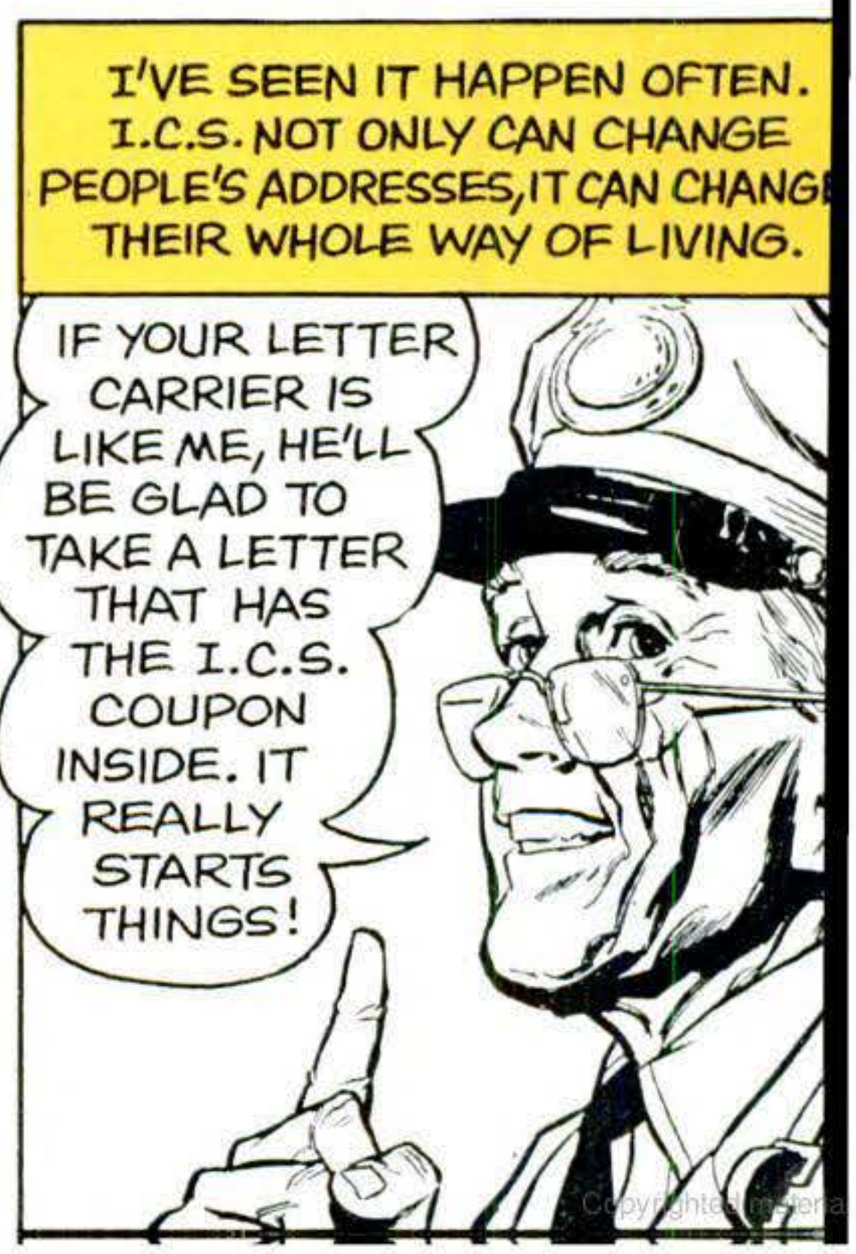
ANDY! YOU'VE BEEN FIGHTING AGAIN! OH, IF ONLY WE COULD LEAVE THIS NEIGHBORHOOD
MAYBE THIS WILL HELP... IT'S FROM INTERNATIONAL CORRESPONDENCE SCHOOLS

SURE ENOUGH, WITHIN A FEW WEEKS I BEGAN TO DELIVER MORE LETTERS AND PACKAGES FROM I.C.S.
WE'RE KEEPING YOU BUSY THESE DAYS. ANDY'S FATHER IS TAKING A CORRESPONDENCE COURSE, YOU KNOW
A SMART MOVE FOR ANY MAN!

IT WASN'T LONG BEFORE I BEGAN TO NOTICE CHANGES IN THE SHOLL'S HOME. LITTLE THINGS. NEW CURTAINS. FLOWER BOXES. FRESH PAINT. AND THEN, ONE MORNING...
LOOK, MR. McCURDY. HOW DO YOU LIKE OUR NEW CAR?
WOW! THAT'S A BEAUTY!
GOSH, ANDY, WILL YOUR POP TAKE US FOR A RIDE IN IT?

A FEW WEEKS LATER, MRS. SHOLL MET ME AS I CAME UP THE STEPS...
HAS ANDY TOLD YOU THE NEWS? WE'RE MOVING. MR. SHOLL IS BEING TRANSFERRED. HE'S TO BE A SECTION LEADER IN THE NEW MILLDALE PLANT. HERE'S OUR NEW ADDRESS

WELL, I'M REAL HAPPY FOR YOU. BUT I'M GOING TO MISS ANDY—AND THAT I.C.S. MAIL
IT WAS YOU AND I.C.S. THAT MADE IT ALL POSSIBLE. WE THANK YOU BOTH!


I'VE SEEN IT HAPPEN OFTEN. I.C.S. NOT ONLY CAN CHANGE PEOPLE'S ADDRESSES, IT CAN CHANGE THEIR WHOLE WAY OF LIVING.
IF YOUR LETTER CARRIER IS LIKE ME, HE'LL BE GLAD TO TAKE A LETTER THAT HAS THE I.C.S. COUPON INSIDE. IT REALLY STARTS THINGS!

Give yourself 2 MONTHS VACATION WITH PLAY!

Count your "days off" from May through October. Most people have 65—two months of playtime you can make the most wonderful days of your life!

Isn't this the time to turn your family gift-giving into one glorious, fun-filled venture? Mark your calendar for memorable days with an Evinrude . . . fishing secluded waters . . . skiing in sun and spray . . . picnicking . . . swimming . . . cruising in the friendly company of boating people who know how to live!

Do what *more* families are doing this Christmas . . . give your family fun afloat with the finest power afloat! See the new '59 Evinrudes . . . most advanced motors in 50 years . . . with new thermostat control . . . new sound-sealed cushioned power . . . 8 smartly-styled new models from 3 to V4 50 hp! See them at your Evinrude dealer (he's listed in your phone book under "Outboard Motors") where easy time payments can turn dreams into reality. Ask for new '59 catalog, or write: **EVINRUDE MOTORS,** 4393 N. 27th Street, Milwaukee 16, Wisconsin. *A Division of Outboard Marine Corporation. In Canada: Mfd. by Evinrude Motors, Peterborough.*

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